GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

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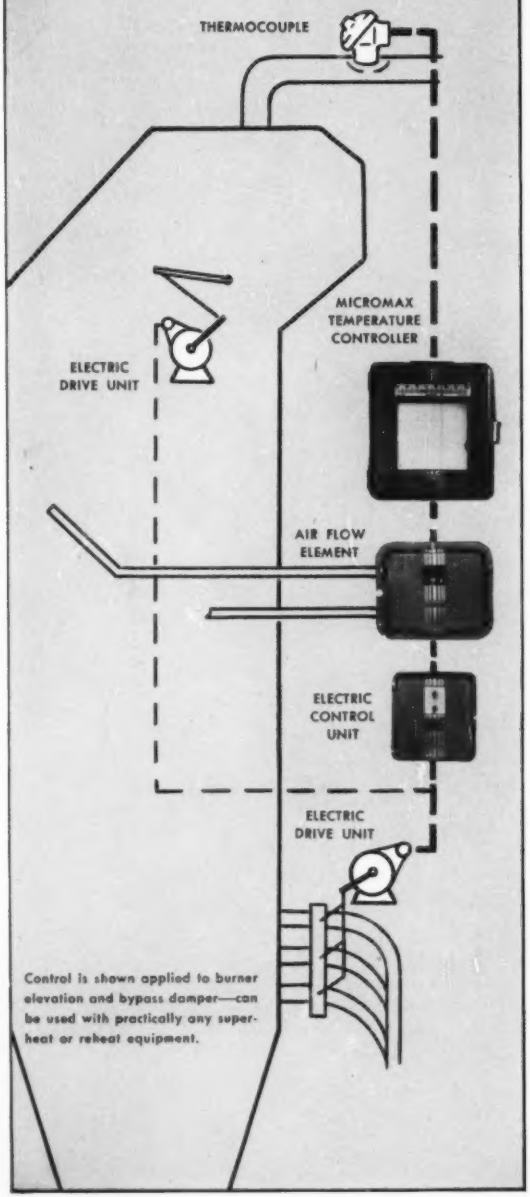
Power

January
1951

A McGRAW-HILL PUBLICATION

4 Reasons for uniform temperature with Micromax Superheat Control



Control is shown applied to burner elevation and bypass damper—can be used with practically any superheat or reheat equipment.

1. HIGH SPEED THERMOCOUPLE responds 3 times as fast as usual detectors for steam header installation. Metal-to-metal contact between couple and its protecting tube speeds heat transfer from steam to the low-mass detecting element. The whole assembly is rugged, stable, withstands vibration, is easily mounted in high-pressure piping.

2. MICROMAX TEMPERATURE CONTROLLER embodies years of L&N know-how in temperature measurement and control. Accurate and sensitive, it operates through its control system to hold superheat at the top safe limit, no matter how boiler load varies. Built into the instrument are features which hundreds of successful installations have proved desirable for superheat control—such as high temperature alarms, provision for safety runback of controlled elements in the event of excess temperature, and thermocouple fail-safe circuit.

3. TWO ELEMENT CONTROL anticipates temperature changes even before they reach the thermocouple. Air Flow Element causes primary movement of dampers, etc., as soon as boiler load varies. Micromax Controller and its associated Electric Control Unit follow with final adjustment based on actual steam temperature

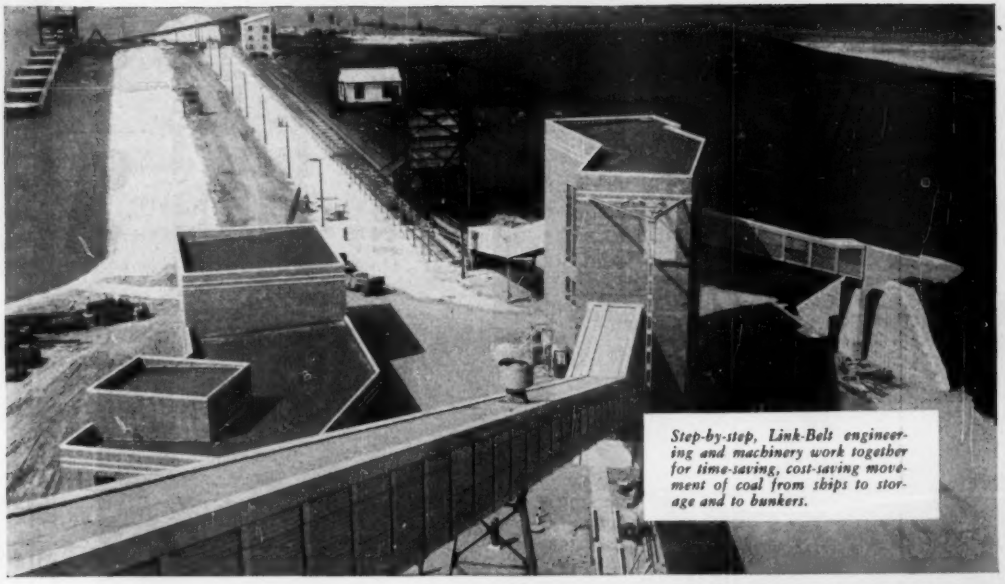
4. ELECTRIC DRIVE UNITS, powerful and reliable, move all controlled elements. High starting torque moves heavy friction loads smoothly and continuously. Worm gear train makes backdriving impossible. Dampers, valves, burners, etc., can be moved readily by hand-wheels in event of power failure. Control lines are electrical wiring, impossible to freeze or clog.

All elements work together to give outstanding performance on any type of superheat equipment; bypass damper, spray desuperheater, attemperator, desuperheating condenser, burner elevation, or any combination of these. For details, write to Leeds and Northrup Company, 4910 Stenton Avenue, Philadelphia 44, Pa.

Ird Ad ND44-33A-463(2)

LEEDS NORTHRUP

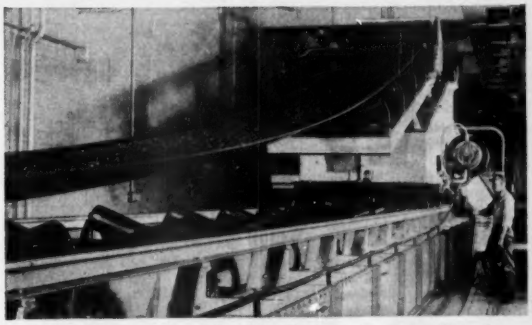
LINK-BELT engineering...



Step-by-step, Link-Belt engineering and machinery work together for time-saving, cost-saving movement of coal from ships to storage and to bunkers.

LINK-BELT equipment...

...combine to cut coal handling costs — from unloading to delivery to power plant bunkers



Link-Belt answers a vital need for the more efficient handling of coal in power plants—large and small. Here a Link-Belt Belt Conveyor and motor-operated traveling tripper distribute coal to bunkers through a dust-tight bin seal.

YOU name your coal handling problem—look to Link-Belt for the answer! Based on experience gained in hundreds of installations in power plants everywhere—Link-Belt has the facilities, the proven equipment, the engineering know-how to carry the ball from start of operations planning to delivery of coal. Regardless of the size of your plant—Link-Belt engineers can recommend exactly what you need for more efficient coal handling.

Conveyors, elevators, feeders, car dumpers and shakers, screens, hoists, hoppers, chutes, gates, stackers, unloading towers, weigh larries and related power plant equipment and accessories—all can be supplied by Link-Belt—*the most complete line* in the field.

So for simpler, more efficient, increased capacity coal handling methods—lower operating and maintenance costs—call on Link-Belt.

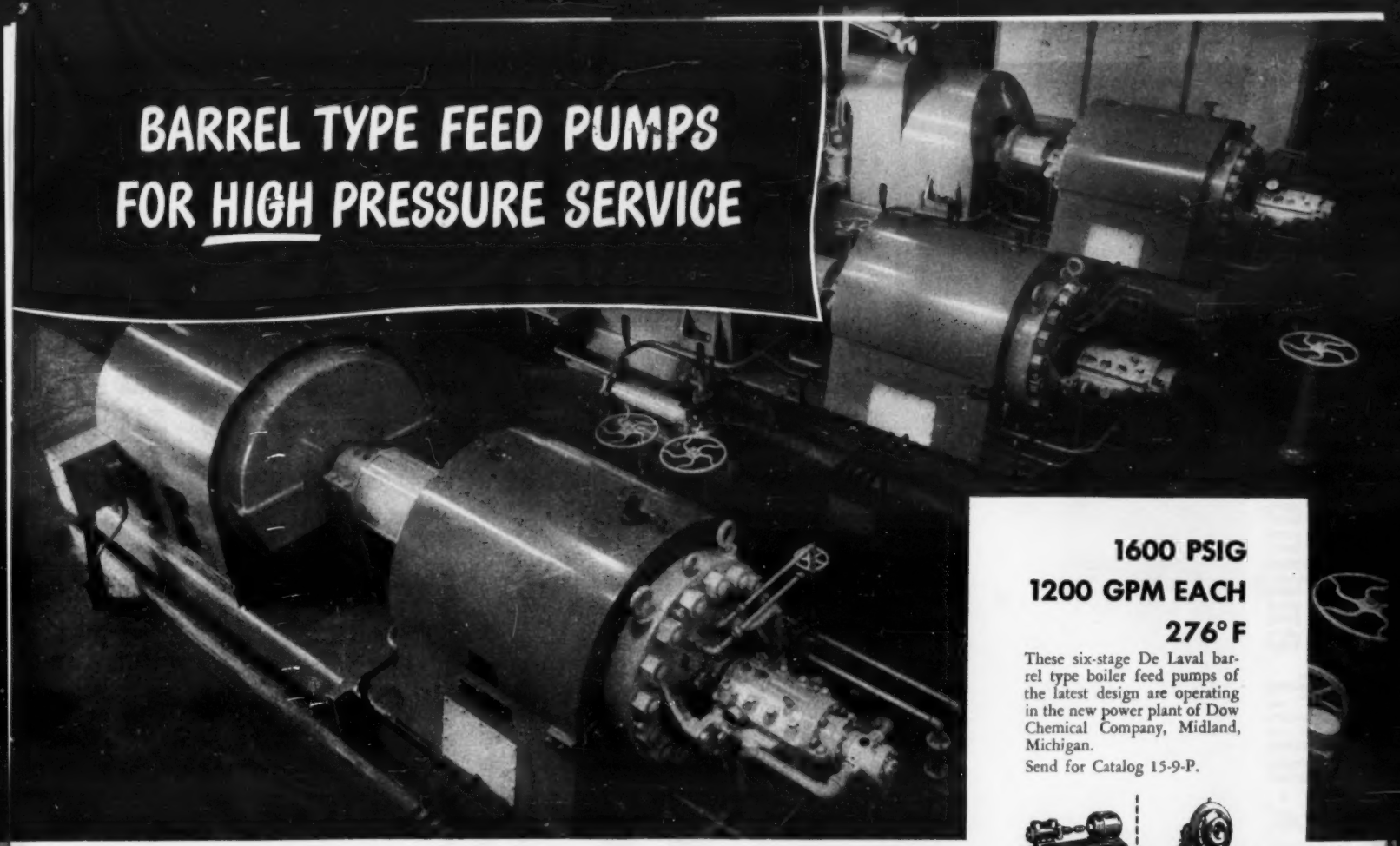
Our engineers will cooperate with you or your consultants to find the most economical solution for your problems. Write for details.

12 204

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities.

LINK-BELT
COAL HANDLING EQUIPMENT

BARREL TYPE FEED PUMPS FOR HIGH PRESSURE SERVICE



1600 PSIG

1200 GPM EACH

276° F

These six-stage De Laval barrel type boiler feed pumps of the latest design are operating in the new power plant of Dow Chemical Company, Midland, Michigan.

Send for Catalog 15-9-P.

BF-9

DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

TURBINES • HELICAL GEARS • CENTRIFUGAL BLOWERS AND COMPRESSORS
CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

DE LAVAL

Power

JANUARY 1951 • VOLUME 95 NUMBER 1

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(Member ABC and ABP)

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POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own index annually, copies of which are available on request to the editorial offices.

ALUMINUM, and its power supply, holds center of stage as mobilization hits high gear. Leading producers have been asked to plan for a 2-billion-lb-per-yr expansion—that means more than 2 million kw.

Preliminary indications are that some new capacity will be gas-engine power (like Alcoa's Point Comfort works) while some will be steam plants burning gas or, possibly, coal at the mine mouth.

Whatever form new aluminum capacity takes, we'll probably see scenes like our cover repeated. In that photo, a worker at the Westinghouse East Pittsburgh works solders armature connections on a synchronous-converter collector.

Next month . . .

■ Another installment of Phil Swain's popular insulation handbook—practical dope on asbestos, insulating concrete, aluminum foil and other modern materials for cutting heat loss.

■ All eyes still focus on America's first commercial power-producing gas turbine—the unit at what used to be called Huey Station (now Belle Isle). Last February we brought you Oklahoma Gas and Electric Co's first operating report on this installation. Next month we'll add another year to the record. Performance still looks good!

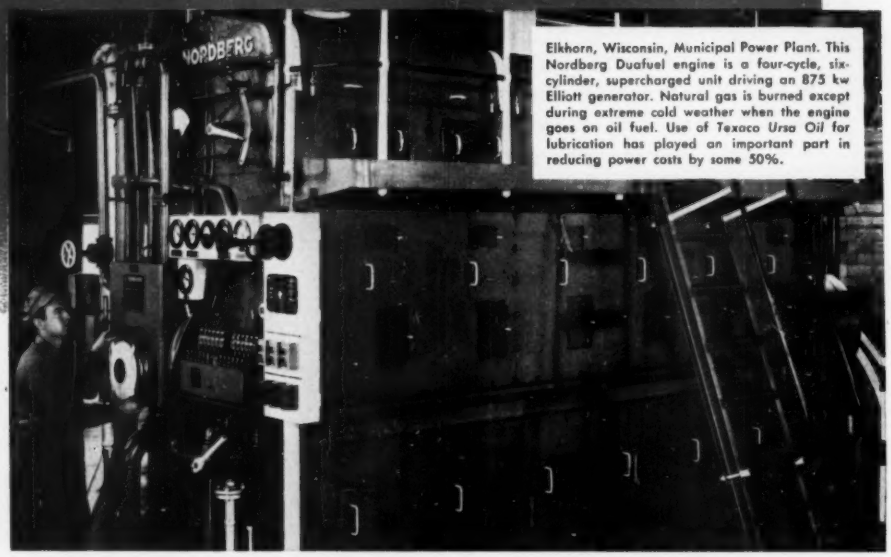
■ For years, paper-industry engineers have wrestled with the problem of disposing of sulfite liquor. Back in January 1949, we told of a new magnesium-base process that forms one solution. Now experiments show calcium-base sulfite liquor—the common garden variety—can be burned successfully without auxiliary fuel. February article reveals how it's done, possible applications.

■ Free-piston compressors have been interesting American engineers because they look good for gas-turbine plants. They also do a job as self-powered air compressors—witness our February report on developments in France.

. . . and future months

■ Watch for the new, revised edition of the Power Handbook—bigger and better than ever! First part now scheduled for March, second part for June.

A record of LOW MAINTENANCE COSTS



Elkhorn, Wisconsin, Municipal Power Plant. This Nordberg Duafuel engine is a four-cycle, six-cylinder, supercharged unit driving an 875 kw Elliott generator. Natural gas is burned except during extreme cold weather when the engine goes on oil fuel. Use of *Texaco Ursa Oil* for lubrication has played an important part in reducing power costs by some 50%.

TEXACO URSA OIL produced 3 savings in this gas-burning Diesel

MR. A. J. WOLFF, Superintendent of the Elkhorn (Wisc.) Light and Water Commission, reports the following cost-saving results from lubricating with *Texaco Ursa Oil:*

1. Clean operation—minimizing wear and assuring lower maintenance costs, longer engine life.
2. Long oil service life.
3. Low lube oil consumption—4301 kw-hrs per gallon.

Low maintenance costs are an old story to operators using *Texaco Ursa Oils* to lubricate Diesel, gas or dual-fuel engines. These world-famous oils have top resistance to oxidation . . . keep engines free from harmful sludge and carbon . . . assure free rings for proper compression and perfect combustion. Lower fuel consumption goes along with lower maintenance costs.

Texaco Ursa Oils are approved by leading engine builders and preferred by operators everywhere. In the Diesel field, for example—

> More stationary Diesel h.p. in the U. S. is lubricated with *Texaco Ursa Oils* than with any other brand.

Let a Texaco Lubrication Engineer help you gain more efficient, more economical engine operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

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...with Power readers...

"A-BOMB DATA HELPFUL . . ."

Phil Swain deserves a medal for making the highly technical information on A-bomb effects understandable in everyday engineering terms. I'm sure many of us will find this A-bomb data helpful in planning protection measures in our own plants. It should also be useful to community civil defense groups. I certainly hope that when the series is complete you will make these articles available in reprint form.

Boston, Mass. — J R Stephens

(All three articles have been reprinted in a single pamphlet, now available from the editorial offices of POWER, 330 W 42 St, New York 18. Single copies cost 25c; 10 to 99 copies cost 20c each; 100-499 copies, 17c each, and 500 or more, 15c each—Ed)

57 YEARS OF POWER

R B (Dick) Wren, plant-maintenance engineer at the State Hospital in Fulton, Mo., recently moved into a smaller house. The one drawback to this move was the fact that his new home had much less storage space than the old one. So, reluctantly, Dick parted with a collection of POWER issues started 57 years ago. The POWER copies, plus those of some other technical magazines, made a good load for a pickup truck—nearly a ton of paper.

Naturally, nothing pleases editors so much as evidence like this of devoted read-

(*Continued on page* 180)

. . . lines and bylines

Sheppard T Powell

WATER TREATMENT has been described as a "bellyache" business. This unlovely term does contain more than a grain of truth. For water, that innocent-looking stuff, is source of many problems for the engineer. And like any man with a pain, he seeks a doctor.

Sheppard T Powell is such a doctor —one of the top practitioners in an intricate and demanding field. For most of his life since graduation from Rensselaer Poly, he has been solving water problems for power and industrial plants here and abroad. In distinguished service with various technical societies and as author of numerous papers and articles, he's done as much as any man to advance the water-treating art. In the public field, he served as a member of the Water Pollution Control Commission for Maryland and as consultant for many government bureaus and federal agencies.

Right now he's busy revising and extending his well-known book on water treatment. The roundup on acid cleaning (p 89) is adapted from one of the new chapters. Watch for more!

B G A Skrotzki

OIL SHALE, like gold, is where you find it. So when Associate Editor Ben Skrotzki wanted to get an on-the-spot story (p 71) he headed West for Rifle, Colo. He's still showing anyone who'll look his color photos of the Rocky Mountain country, which he took, he says, on weekends and out of working hours.

To bolster his tale of a hardworking trip (close to 5000 miles of it) Ben brought back interesting reports of visits with central-station men and consulting engineers from Kansas City to Denver and as far south as Tulsa. Things are booming along out there, as you'll be hearing when Ben gets some of his findings on paper. Incidentally, while in Oklahoma City he took a look-see at OG&E's gas turbine, then some 9000 hr old. Keep an eye out for operating figures in Feb POWER.

Charles L Pope

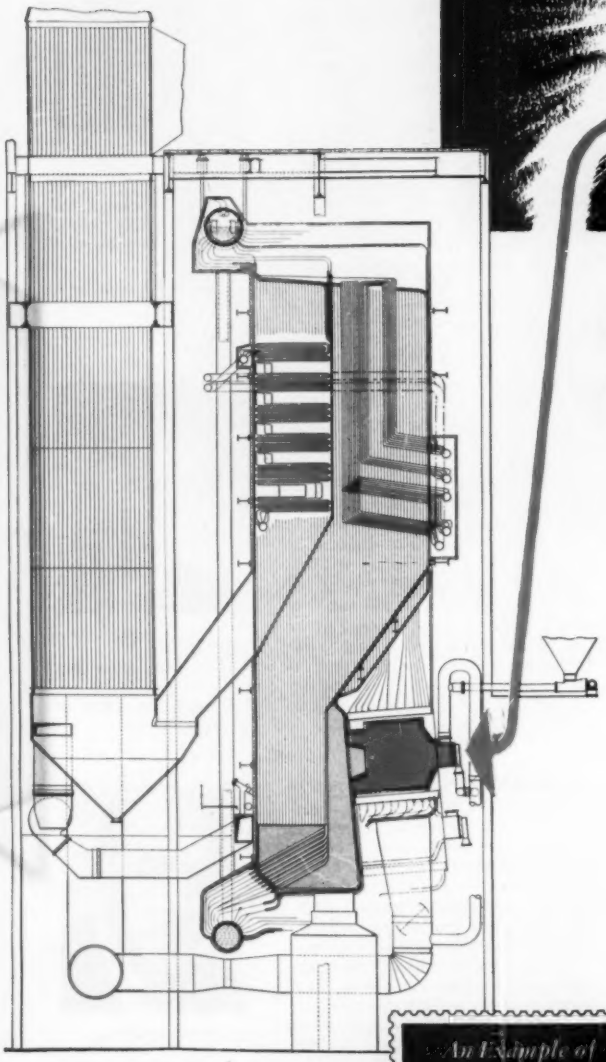
MR LUBRICATION would be an apt title for Eastman Kodak's Charles L Pope. As head of the lubrication section, engineering and maintenance division, Kodak Park plant, and consultant on lubrication for the rest of the far-flung Eastman organization, he bumps against just about every kind of lube problem, all multiplied by hundreds or thousands.

Charlie devotes his spare time to another great interest—lubrication. He's chairman of the president's council of American Society of Lubrication Engineers (and a past president). In 1949, his contributions to the art of lubrication won for him the first award of ASLE's Alfred E Hunt Medal. When ASME formed a lubrication coordinating committee, Charlie was chosen as its first chairman. He also serves on a number of ASTM and industry committees dealing with lubricants.

On p 108 you'll find some of Charlie's sound and practical thinking.

Start here

with cost-saving B&W Cyclone-Furnace Boilers



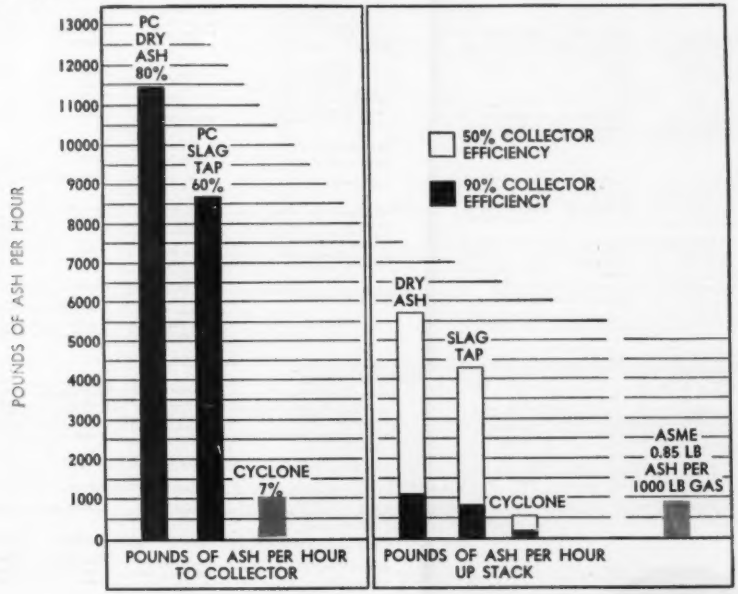
- **Savings**
  through simplification of collectors and ash-handling equipment, due to drastically reduced volume of fly-ash leaving the furnace.
- **Savings**
  through lower cost and maintenance of coal preparation equipment.
- **Savings**
  through higher boiler efficiency due to low excess air.
- **Savings**
  through reduction of boiler and building size.

An Example of B&W Engineering for Economy

for STACK DUST CONTROL

The logical place to *start* controlling fly-ash is *in the furnace*, where it is produced. B&W's unique Cyclone-Furnace recovers extremely high percentages of ash in the form of easy-to-handle slag. Your collectors handle only a small fraction of the dust-loading they would normally receive from pulverized-coal fired boilers, even those of the slag-tap furnace type. This big advantage, illustrated in a typical case study below, is only one of several that account for selection, since 1946, of Cyclone-Furnace Boilers with total steam capacity exceeding 14 million pounds per hour.

750,000 LB PER HR BOILER—16% ASH—10,000 BTU COAL—14,250 LB ASH PER HR



Helping Industry Cut Steam Costs Since 1867

BABCOCK & WILCOX

G-314T

80.4% OF THESE INSTALLATIONS DIAMOND

1950 Design Survey of Typical New

Compiled by B G A Skrotzki, Associate Editor

Company	Location	Plant Name	Consulting Engineers
1500 PSIG AND ABOVE			
Indiana & Michigan Electric Co	Lawrenceburg, Ind.	Tanners Creek	Amer. Gas & Elec Co
Consolidated Edison Co of N. Y.	Astoria, Queens, N.Y.	Astoria	
Central Hudson Gas & Elec Corp.	Dansksmmer Pt, N.Y.	Dansksmmer	Burns & Roe, Inc
Jersey Central Power & Light Co.	South Amboy, N.J.	South Amboy	Burns & Roe, Inc
Wisconsin Electric Power Co.			
Long Island Lighting Co	Glenwood Land'g, NY	Glenwood No. 3	Ebasco Services, Inc
Public Service Elec & Gas Co.	Sewaren, N.J.	Sewaren	
1000 TO 1499 PSIG			
Toledo Edison Co.	Toledo, Ohio	Acme	G W Southoff
Cincinnati Gas & Elec Co.	New Richmond, Ohio	Clermont	Electric Advisers, Inc.
Central Illinois Publ Service Co.	Hutsonville, Ill.	Hutsonville	Sargent & Lundy
Virginia Electric & Power Co.	Wheelwright, Va.	Chesterfield	Stone & Webster
Carolina Pwr & Light Co.	Lumberton, N. C.	Lumberton	Ebasco Services Inc
Carolina Pwr & Light Co.	Goldsboro, N. C.	Goldsboro	Ebasco Services Inc
Niagara-Mohawk Pwr Corp.	Nr Albany, N. Y.	Albany	
New York State Elec & Gas Corp.	Johnson City, N. Y.	Gaudey	Gilbert Associates Inc
Illinois Power Co.	W. of LaSalle, Ill.	Hennepin	Sargent & Lundy
Florida Power & Light Co.	Nr Miami, Fla.	South Florida	Ebasco Services Inc
Potomac Electric Power Co.	Washington, D. C.	Benning	Stone & Webster
Duke Power Co.	Mt. Holly, N. C.	Riverbend	
Duquesne Light Co.	Elrama, Pa.	Elrama	
Iowa Power & Light Co.	Des Moines, Iowa	Des Moines, No. 2	United Lt & Pwr Serv. United Lt & Pwr Serv. Black & Veatch
Texas Electric Service Co.	Fort Worth, Texas	North Main	Ebasco Services, Inc
Wisconsin Power & Light Co.	Sheboygan, Wis	Edgewater	Sargent & Lundy
Georgia Power Co.	Yates, Ga.	Yates	Southern Services, Inc.
Columbus & S. Ohio Elec Co.			Ebasco Services Inc
Minnesota Power & Light Co.	Aurora, Minn.	Aurora	Ebasco Services Inc
San Diego Gas & Electric Co.	San Diego, Calif.	Silver Gate	Pioneer Serv & Engrg.
Pennsylvania Electric Co.	Erie, Pa.	Front St	Gilbert Associates, Inc
Florida Power Corp.	Oldsmar, Fla. Avon Park, Fla. St. Petersburg, Fla.	Booth Point Avon Park Bayboro	Kuljian Corp Kuljian Corp Kuljian Corp
800 TO 999 PSIG			
Northern States Power Co.	Minneapolis, Minn.	Riverside Black Dog	Pioneer Serv & Engrg. Pioneer Serv & Engrg.
New York State Elec & Gas Corp.	East Corning, N. Y.	Hickling	Gilbert Associates, Inc
Eastern Shore Publ Service Co.	Vienna, Md.	Vienna	United Engrs & Constr.
Hydro-Elec Pwr Comm of Ontario	Toronto, Ont. Windsor, Ont.	Richard L Hearn Windsor	Stone & Webster H G Acres & Co
Union Electric Power Co.	Venice, Ill.	Venice No. 2	Stone & Webster
Southern California Edison Co.	Redondo Beach, Calif.	Redondo	Stone & Webster
Hartford Electric Light Co.	Hartford, Conn.	South Meadow	Stone & Webster
Public Service Co of Colorado	Denver, Colo.	Arapahoe	Ebasco Services, Inc
Alabama Power Co.	Chickasaw, Ala.	Chickasaw	Southern Services, Inc.
Mississippi Power Co.	Hattiesburg, Miss. Meridian, Miss.	Eaton Sweatt	Southern Services, Inc. Southern Services, Inc.
600 TO 799 PSIG			
Iowa Public Service Co.	Sioux City, Iowa	Kirk	
Southern Colorado Power Co.	Pueblo, Colo.	Pueblo	Pioneer Serv & Engrg.
Maine Public Service Co.	Rocky Ford, Colo.	Rocky Ford	Stearns-Roger Mfg Co.
Western Colorado Power Co.	Caribou, Maine.	Caribou	Stone & Webster
Mt Carmel Public Utility Co.	Montrose, Colo.	Montrose	
	Mt Carmel, Ill.		
UNDER 600 PSIG			
Southwestern Publ Service Co.	Sunray, Texas	Moore County	Stearns-Roger Mfg Co.
Saskatchewan Power Corp.	Estevan, Sask.	Estevan	W E Hauright
Otter Tail Power Co.	Creakston, Minn.	Creakston	J F Pritchard & Co.
Montana-Dakota Utilities Co.	Mobridge, S.D.	Mobridge	Stearns-Roger Mfg Co.
Iowa Public Service	Carroll, Iowa	Carroll	Black & Veatch
Central Kansas Power Co.	Colby, Kansas	Colby	
Northern States Power Co.	Fargo, N.D.	Fargo	Pioneer Serv & Engrg.
Iowa Southern Utilities Co.	Centerville, Iowa Ottumwa, Iowa	Centerville Ottumwa	Federal Engrg Co. Federal Engrg Co.
Pacific Power & Light Co.	Yakima, Wash.	Ste Hg Plant	J Donald Kroecker
MUNICIPAL AND COOPERATIVE PLANTS			
Board of Public Utilities	Kansas City, Kansas	Quindaro No. 2	Burns & McDonnell
Central Power Electric Coop Inc	Voltaire, N.D.	Wm J Neal	Vern E Alden Co.
Dairyland Power Cooperative	Alma, Wis. Lacrosse, Wis.	Alma	Vern E Alden Co.
City of Muscatine	Muscatine, Iowa	J J Stoneman	Vern E Alden Co. Stanley Engrg Co.
Corn Belt Power Cooperative	Humboldt, Iowa	Humboldt	Stanley Engrg Co.
Southwestern Federated Pwr Coop.	Crosbyton, Iowa	Crosbyton	Stanley Engrg Co.
Brazos Riv Transmission Elec Coop.	Belton, Texas	Bob Poage	Laramore & Douglass
City of Tallahassee	St Marks, Fla.	St Marks	Reynolds, Smith & Hi
City of Lafayette	Lafayette, La.		Barnard & Burk
Minnkota Power Cooperative	Grand Forks, N.D.	Franklin P Wood	Ellerbe & Co.
Dept of Municipal Service	Wyandotte, Mich.		Emery, Markest, Emery
Water, Gas & Electric Dept	Danville, Va.	Brantly	Chas T Main, Inc.
Manitowoc Public Utilities	Manitowoc, Wis.		
Greenville Utilities Commission	Greenville, N.C.	Greenville	W C Olsen
Borough of Chambersburg	Chambersburg, Pa.		A C Wood Assoc
City Water & Light Dept	Ottawa, Kansas		Black & Veatch
City of Jackson	Jackson, Minn.		Pfeifer & Shultz
Borough of Etna	Etna, Pa.		
Department of Utilities	Fremont, Nebr.		Lutz & May
Orrville Municipal Utilities	Orrville, Ohio	N Vine St	H R Hadlow
City of Colorado Springs	Colorado Springs, Colo		Lutz & May
Water & Light Department	Thomasville, Ga.		
City of Cedar Falls	Cedar Falls, Iowa		Stanley Engrg Co.
Frankfort Light & Power Plant	Frankfort, Ind.		Emery, Markest, Emery
City of Weyburn	Weyburn, Sask.		
City of Medicine Hat	Medicine Hat, Alberta		

Company	Location	Plant Name	Consulting Engineers	First operation, mo-yrs	Nominal pressure, psig	Nominal temperature, F
1500 PSIG AND ABOVE						
Indiana & Michigan Electric Co	Lawrenceburg, Ind.	Tanners Creek	Amer. Gas & Elec Co	1-51[1]	2000	1050[2]
Consolidated Edison Co of N. Y.	Astoria, Queens, N.Y.	Astoria		12-52 4-53	1800	1000[2]
Central Hudson Gas & Elec Corp.	Dansksmmer Pt, N.Y.	Dansksmmer	Burns & Roe, Inc	1-53[2]	1650	1000[2]
Jersey Central Power & Light Co.	South Amboy, N.J.	South Amboy	Burns & Roe, Inc	12-52	1650	1000[2]
Wisconsin Electric Power Co.				12-52	1575	1000[2]
Long Island Lighting Co	Glenwood Land'g, NY	Glenwood No. 3	Ebasco Services, Inc	1952	1525	1000[2]
Public Service Elec & Gas Co.	Sewaren, N.J.	Sewaren		1951	1500	1050[2]
1000 TO 1499 PSIG						
Toledo Edison Co.	Toledo, Ohio	Acme	G W Southoff	1951 2-49	1450 820	1000 950
Cincinnati Gas & Elec Co.	New Richmond, Ohio	Clermont	Electric Advisers, Inc.	3-53	1450	1000[2]
Central Illinois Publ Service Co.	Hutsonville, Ill.	Hutsonville	Sargent & Lundy	1952	1450	1000[2]
Virginia Electric & Power Co.	Wheelwright, Va.	Chesterfield	Stone & Webster	5-52	1450	1000[2]
Carolina Pwr & Light Co.	Lumberton, N. C.	Lumberton	Ebasco Services Inc	6-52	1450	1000[2]
Carolina Pwr & Light Co.	Goldsboro, N. C.	Goldsboro	Ebasco Services Inc	6-52	1450	1000
Niagara-Mohawk Pwr Corp.	Nr Albany, N. Y.	Albany		1952	1450	1000
New York State Elec & Gas Corp.	Johnson City, N. Y.	Gaudey	Gilbert Associates Inc	1951	1450	1000
Illinois Power Co.	W. of LaSalle, Ill.	Hennepin	Sargent & Lundy	10-53	1450	1000
Florida Power & Light Co.	Nr Miami, Fla.	South Florida	Ebasco Services Inc	8-52	1450	1000
Potomac Electric Power Co.	Washington, D. C.	Benning	Stone & Webster	1952	1450	1000
Duke Power Co.	Mt. Holly, N. C.	Riverbend		5-52 7-52	1300 1300	950 950
Duquesne Light Co.	Elrama, Pa.	Elrama		12-51	1300	950
Iowa Power & Light Co.	Des Moines, Iowa	Des Moines, No. 2	United Lt & Pwr Serv. United Lt & Pwr Serv. Black & Veatch	8-48 5-49 12-50	1290 600 1290	925 750 925
Texas Electric Service Co.	Fort Worth, Texas	North Main	Ebasco Services, Inc	3-52	1250	955
Wisconsin Power & Light Co.	Sheboygan, Wis	Edgewater	Sargent & Lundy	6-51	1250	950
Georgia Power Co.	Yates, Ga.	Yates	Southern Services, Inc.	1952	1250	950
Columbus & S. Ohio Elec Co.			Ebasco Services Inc	1953	1250	950
Minnesota Power & Light Co.	Aurora, Minn.	Aurora	Ebasco Services Inc	3-53	1250	950
San Diego Gas & Electric Co.	San Diego, Calif.	Silver Gate	Pioneer Serv & Engrg.	8-50	1250	950
Pennsylvania Electric Co.	Erie, Pa.	Front St	Gilbert Associates, Inc	7-52	1250	950
Florida Power Corp.	Oldsmar, Fla. Avon Park, Fla. St. Petersburg, Fla.	Booth Point Avon Park Bayboro	Kuljian Corp Kuljian Corp Kuljian Corp	5-51 1953 7-52 12-49	1250 1250 1250 850	950 950 950 900
800 TO 999 PSIG						
Northern States Power Co.	Minneapolis, Minn.	Riverside Black Dog	Pioneer Serv & Engrg. Pioneer Serv & Engrg.	7-50 6-52	900 850	900 950
New York State Elec & Gas Corp.	East Corning, N. Y.	Hickling	Gilbert Associates, Inc	1952	850	950
Eastern Shore Publ Service Co.	Vienna, Md.	Vienna	United Engrs & Constr.	4-51	850	900
Hydro-Elec Pwr Comm of Ontario	Toronto, Ont. Windsor, Ont.	Richard L Hearn Windsor	Stone & Webster H G Acres & Co	11-51 9-51	850 850	900 900
Union Electric Power Co.	Venice, Ill.	Venice No. 2	Stone & Webster	10-50 12-50	850 850	900[3] 900
Southern California Edison Co.	Redondo Beach, Calif.	Redondo	Stone & Webster	1949	850	900
Hartford Electric Light Co.	Hartford, Conn.	South Meadow	Stone & Webster	4-50	850	900
Public Service Co of Colorado	Denver, Colo.	Arapahoe	Ebasco Services, Inc	10-50 4-51 1952	850 850 850	900[3] 900 900
Alabama Power Co.	Chickasaw, Ala.	Chickasaw	Southern Services, Inc.	1951	850	900
Mississippi Power Co.	Hattiesburg, Miss. Meridian, Miss.	Eaton Sweatt	Southern Services, Inc. Southern Services, Inc.	8-49 3-51	850 850	900 900

A – Air cooled
AAd – Arsenical Admiralty
AC – Allis-Chalmers Mfg Co
Ad – Admiralty
Adi – Admiralty, inhibited
AlB – Aluminum-bronze
AlBr – Aluminum-brass
AsAd – Antimony-Admiralty
As – Asiatic
AsAd – Arsenical Admiralty
AsCu – Arsenical copper
BW – Babcock & Wilcox Co
C – Coal, bituminous
CE – Combustion Engineering-Superheater, Inc.
CP – C A Parsons
CuNi – Copper-nickel
DL – DeLaval Steam Turbine
EC – Erie City Iron Works
EE – English Electric
EL – Elliott Co
EW – Edge Moor Iron Works, I
FW – Foster Wheeler Corp.
G – Natural gas
GE – General Electric
H – Hydrogen
Hy – Hydraulic

List Published in POWER, December, 1950

HAVING SOOT BLOWERS HAVE

SOOT BLOWERS

Steam Central-Station Installations

ypical New Steam Central-Station Installations

BOILERS													F-D FANS	I-D FANS	FUEL	FEED PUMPS	TURBINES								CONDENSERS									
	Capacity, each, 1000 lb per hr	Manufacturer	Boiler, waterwall surface, 1000 sq ft	Superheater surface, 1000 sq ft	Furnace volume, 1000 cu ft	Heat release, 1000 Btu per cu ft per hr	Furnace bottom	Economizer surface per boiler, 1000 sq ft	Air heater surface per boiler, 1000 sq ft	Air heater type	Drive																						
	930	BW	31.0	95.9[2]	79.8	16.4	DB	.....	51.8	.....	M																						
							.....	.....	.....	.....	.....																							
							DB	0	72.5	Tu	M																						
							DB	0	61.2	Re	M																						
2	1200	BW	22.7	35.0	93.0	17.0	DB	.....	34.1	Tu	M[3]																						
							.....	6.1	17.2	.....	.....																						
	500	CE	20.5	32.4[1]	27.2	22.5	.....	10.5	127.5	Tu	M																						
	475	BW	15.0	37.6[1]	12.7	45.2	DB	34.6	60.1	Tu	M																						
1	795	CE	37.3	18.3[1]	102.0	10.4	DB	34.6	60.1	Tu	M																						
	750	CE	33.1	.....	62.0	16.1	DB	20.4	111.0	Pl	M																						
	822	CE	18.2	69.1[2]	67.8	16.1	DB	.....	66.6	Tu	M																						
							DB	.....	.....	Re	M																						
							DB	.....	.....	Re	M																						
							DB	.....	.....	Re	M																						
1	650	BW	21.7	32.6	47.4	16.9	.....	.....	.....	.....	.....																						
2	500	BW	39.5	.....	49.5	16.3	.....	.....	55.8	Re	M																						
1	706	CE	36.0	70.3[2]	64.2	14.7																											
1	525	CE	.....	.....	.....	.....																											
1[7]	750	CE	34.0	66.0	39.0	26.0	.....	3.8	6.9	Tu	M																						
1	550	CE	26.1	35.0	39.0	18.6	DB	0	31.8	Re, Pl	M																						
							DB	0	16.0	Tu	Mp																						
1	550	CE	26.1	35.0	39.0	18.6	DB	2.1	6.6	Tu	M																						
2	675	CE	32.8	42.3	58.0	15.8	DB	0	14.0	Tu	M																						
1	560	CE	29.3	43.7[2]	44.6	17.0	.....	2.0	4.8	Tu	M																						
1	525	CE	.....	.....	.....	.....																											
1	550	CE	26.1	35.0	39.0	18.6																											
1	675	CE	30.7	.....	55.4	14.4																											
1	810	CE	40.5	44.3[2]	68.0	15.6	DB	0	27.8	Re	M																						
1	810	CE	40.5	44.3[2]	68.0	15.6	.....	0	4.8	.....	M																						
1	860	BW	28.9	35.1	69.8	.....	.....	0	6.3	.....	.....																						
1	375	CE	18.0	13.5	24.5	19.0	.....	0	4.9	Tu	M																						
	.....	.....	.....	.....	.....	.....	.....	1.5	3.7	Tu	M																						
1	375	CE	27.1	14.5	25.2	18.4																											
							DB	0	9.8	Tu	M																						
1	775	CE	.....	.....	.....	.....	.....	0	5.0	Tu	M																						
1	660	BW	13.2	31.1	24.1	30.0	.....	.....	.....	.....	.....																						
1	975	CE	40.9	36.2	74.0	15.4	.....	.....	.....	.....	T																						
1	650	CE	27.0	.....	44.0	18.0	.....	.....	.....	.....	M																						
2	425	CE	15.7	16.2	31.0	17.9																											
1	575	BW	9.7	21.0	25.0	28.7																											
2	400	CE	19.2	25.7	25.5	19.6	ST	0	65.3	Re	M																						
							DB	0	58.4	Tu	M																						
1	450	BW	.....	.....	26.0	.....	DB	0	54.0	Tu	M																						
1	450	BW	.....	.....	26.0	.....	DB	0	54.0	Tu	M																						
1	450	BW	.....	.....	26.0	.....	.....	11.5	0	.....	Mp																						
1	330	BW	21.9	.....	.....	24.3																											
							.....	2.9	6.6	Tu	Mp																						
							.....	2.5	6.3	Tu	Mp																						
							DB	0	14.6	Tu	M																						
							.....	.....	4.8	Tu	M																						
1	570	BW	13.5	22.9	37.5	20.8	DB	0	5.9	Tu	M																						
1	600	CE	17.4	21.0	43.2	17.6	.....	4.4	16.8	Tu	M																						
2	220	BW	24.4	8.7	12.5	22.4	.....	2.1	8.6	Tu	M																						
1	300	BW	23.3	10.6	21.0	17.6	.....	.....	.....	.....	M,T																						
1	850	BW	49.1	18.8	69.6	15.5	DB	0	7.8	Tu	M																						
2	650	BW	44.4	17.6	52.5	15.0																											
							DB	11.6	0	.....	M																						
1	900	BW	29.0	29.2	83.8	13.7	DB	0	.....	Tu	M																						
1	900	BW	29.0	29.2	83.8	13.7	DB	.....	.....	Tu	M																						
							DB	.....	0	.....	.....																						
3	400	BW	7.3	14.8	13.9	39.0	DB	0	4.3	Tu	T																						
1	450	BW	25.7	14.4	38.4	14.7	.....	0	0	.....	M[3]																						
							.....	.....	0	.....	Mp																						
							.....	.....	.....	.....	M[3]																						
1	450	BW	33.1	19.8	41.9	14.3	DB	0	3.9	Tu	M																						
1	450	BW	33.1	19.8	41.9	14.3	DB	.....	7.3	Tu	M	D	M	Fly	P	C	13.0	2650	1w,1T	R	5	3600	WE	1.25	3	A	6.0	2	Ad
1	450	BW	33.1	19.8	41.9	14.3																											
1	425	CE	27.2	10.5	21.2	24.0	.....	5.5	0	.....	M	V	M	V	SS	C	11.0	2100	1w,1T	R	5	3600	GE	1.0	3	A	4.0	1	Ad
1	230	RS	20.2	7.8	14.8	20.2	.....	2.9	0	.....	MT	Ma,V	MT	Ma,V	SS(252)	C	11.2	2000	2w,1T	R	10	3600	EI	.....	.....	.....	.....	.....	.....
1	425	BW	9.9	10.4	22.3	24.3	.....	.....	0	.....	M	.....	M	Ma	SS(84)	L	.....	.....	2w	.....	1.5	3600	CP	0.75	2	A	2.1	2	.....
							DB	0	0	.....	M	D,V	M	.....	G	G	980[14]	.....	2T	R	5	3600	CP	0.75	3	A	4.8	2	.....

L – Lignite
M – Motor drive
Ma – Magnetic coupling
MT – Murray Iron Works Co
Mp – Two motors per fan
MT – One motor, one turbine per fan
[illegible] – metal

Pl – Plate
R – Regulator
Re – Regenerative
RS – Riley Stoker Corp
S – [illegible]
SP – [illegible] Co

TG – Traveling-grate stoker
Tu – Tubular
UF – Underfeed stoker
UI – Union Iron Works
V – Vane control
WB – Wm Bros Boiler & Mfg Co
WE – Westinghouse Electric Corp
WI – Wickes Boiler Co

5–Revised, first listed 1949 survey
7–Reheat to 1000F
8–Includes reheater
9–AIEE-ASME preferred standard
10–7,500 kw house generator
11–AIB in air-cooler section
12–Forced circulation
13–2 units

10–Two-section
11–Bio pe
12–2 fans
13–Extract
14–Alch

"Cleaner boilers at lower cost" . . . that is the reason why the central stations (the most critical buyers) express such overwhelming preference for Diamond Soot Blowers year-after-year-after-year. Diamond performance superiority is based upon better design, correct application engineering and the unique Diamond Service Policy.

At the time this advertisement was prepared, soot blower requirements had been purchased by all but three plants on the list. This will not significantly affect the result.

Diamond Dominates in Soot Blowers . . . now as in previous years . . . because Diamond Soot Blowers mean better boiler cleaning at lower cost.

DIAMOND POWER SPECIALTY CORP.

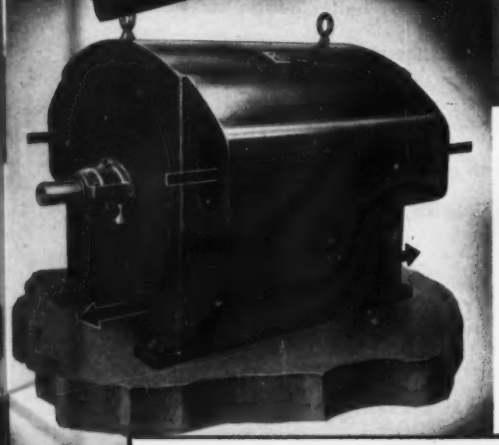
LANCASTER, OHIO

Diamond Specialty Limited, Windsor, Ontario

You're a step ahead

the deaerating heater that makes unnecessary the tubular vent condenser

the outdoor motor that laughs at wet weather



the high pressure turbocharger that further boosts diesel power

The Elliott Line-up

TURBINE-GENERATORS
DEAERATING HEATERS
GENERATORS FOR DIESELS, ETC.
TURBOCHARGERS FOR DIESELS
CENTRIFUGAL BLOWERS
CONDENSERS
MECHANICAL DRIVE TURBINES
STEAM JET EJECTORS
STRAINERS
TUBE CLEANERS
MOTORS—(Integral, Crocker Wheeler Div.)
(Large, Ridgway Div.)

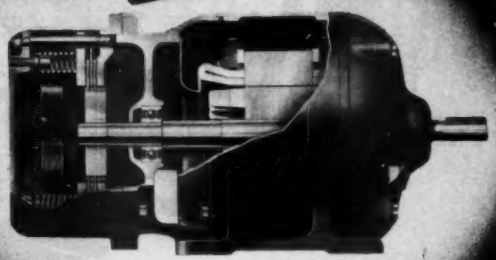
with... ELLIOTT

Getting the jump on the field has become a tradition with Elliott engineers. As for instance in the development of heavy, high-speed centrifugal blowers . . . the pioneering of deaeration and the development of its equipment . . . the initiating of an entirely new technique as applied to the fabricating of steel in large motors and generators . . . the skillful designing of a turbine line which brings the advantages of standardization to practically any special application . . . the recognition of supercharger possibilities for diesels, and the combining of Elliott skills in the development of a highly successful turbocharger.

These, and other similar achievements make the big "E" in the familiar trade mark symbolize Exceptional Excellence in Engineering, as well as the name ELLIOTT.

the mechanical drive turbine that makes standardization flexible

the brake motor that sets new standards in high performance and low maintenance



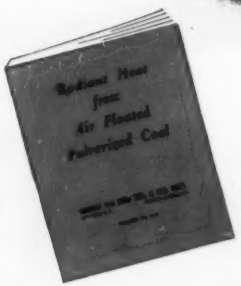
Q-1148

ELLIOTT COMPANY

JEANNETTE, PA.

PLANTS AT:
JEANNETTE, PA.
RIDGWAY, PA.
AMPERE, N. J.
SPRINGFIELD, O.
NEWARK, N. J.
DISTRICT OFFICES
IN PRINCIPAL CITIES

KVS offers



Send for a copy of 97-page Engineering Bulletin No. 44-B, containing valuable information on steam generation and coal pulverization.

A WORLDWIDE SERVICE
under a single responsibility

COMPLETE PLANTS *Anywhere* ON THE MAP

THE Worldwide service of KVS has been developed and built from successful plants in far off places which are producing power for their owners on whatever fuels are available. Where such fuels as tailings, washings and screenings are used, KW power costs are extremely low, because with KVS equipment such fuels can be burned with complete satisfaction as well as at highest economy.

Thus it is quite safe to make the general statement that KVS plants can be erected complete and guaranteed for low cost power in any part of the world where fuel and water are available.

In offering this service, KVS also takes full responsibility for the overall performance of the plant when taken over by its owner. By having this responsibility centered in an organization well equipped to assume it, there can be no misunderstandings as to who is standing back of pulverizers, boilers, turbines, generators, etc. If KVS supplies the equipment, whether or not built in KVS shops, KVS will guarantee it.

Let us cooperate with you on your requirements . . . wherever you are located.

KENNEDY-VAN SAUM · QUALITY · SERVICE · Kennedy Products · NEW YORK USA · MFG. & ENG. CORP.

Kennedy-Van Saum

MANUFACTURING AND ENGINEERING CORPORATION

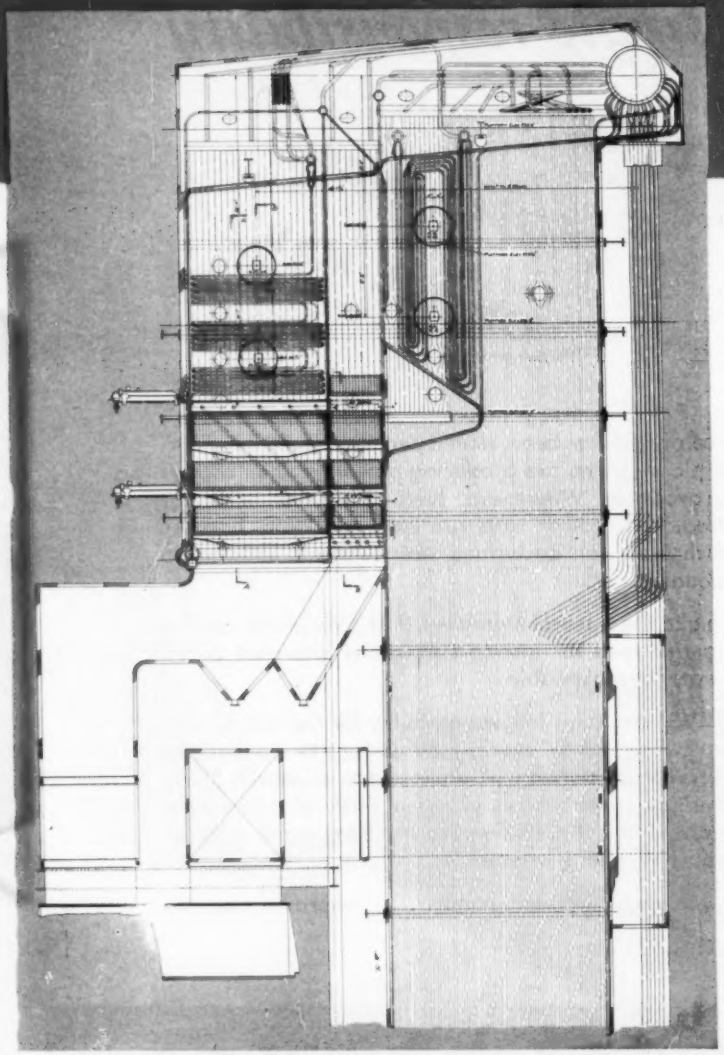
ARMY E NAVY

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • FRANCE • AUSTRALIA

It's VULCAN for



● B & W Radiant-Type Boiler fired with pulverized coal. Rated at 1,370,000 pounds of steam per hour at 1700 psi and 1050 degrees F.

● 18 Vulcan long retractables; 10 for the by-pass and economizer sections, 8 for primary and secondary superheaters. 2 Vulcan controls for air-heater cleaners. All blow with steam, under automatic-sequential control; air-driven.

VULCAN -Automatic

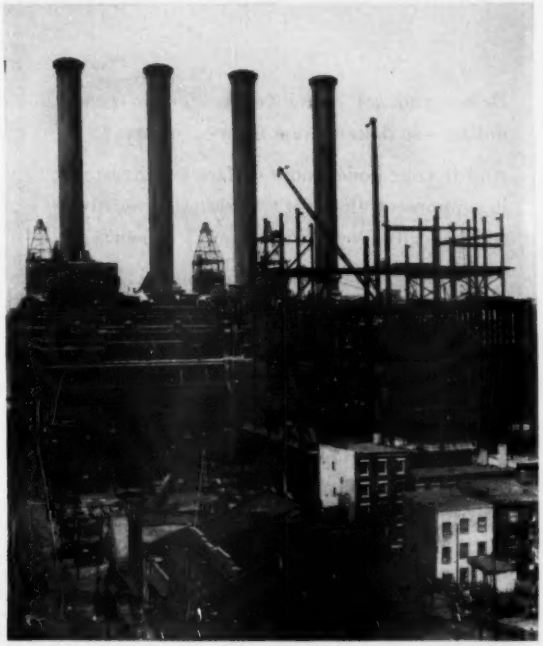
the FIRST 1,370,000 pounds-per-hour boiler

HUDSON AVENUE STATION
CONSOLIDATED EDISON COMPANY OF NEW YORK

FOR the eighth time, Consolidated Edison Company of New York —world's largest public utility—has purchased Vulcan to keep an important boiler free from soot and slag. This time it's for Hudson Avenue Station, where the world's first 1,370,000-pounds-per-hour boiler is being erected.

The Vulcan Automatic-Sequential Soot Blowing System includes eighteen long retractables and two special air-heater cleaners—all air-driven, all to blow with steam.

Whether you prefer to blow with air or steam, depend on Vulcan for optimum cleaning efficiency with low operating and maintenance costs. Let a Vulcan engineer show you how and why.



Showing structural work in progress at Hudson Avenue Station for one of the world's largest boilers. General boiler arrangement on facing page.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DuBois, Pennsylvania

How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

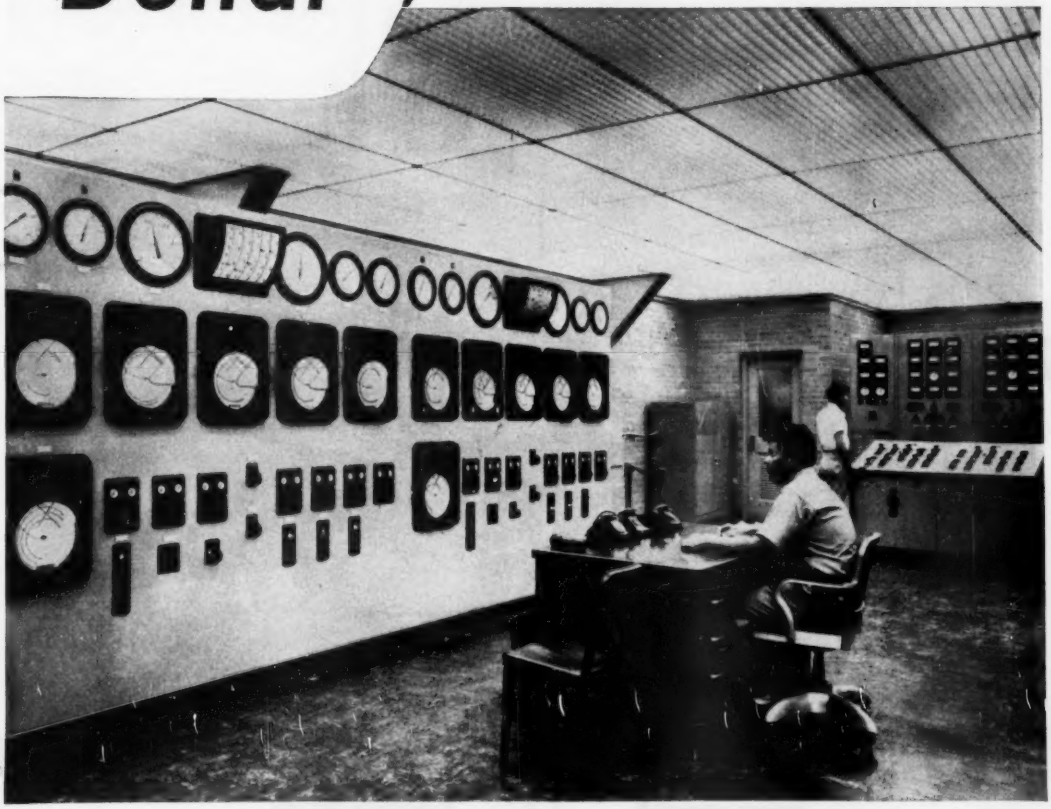
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-1

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

INCREASE of YOUR Dollar

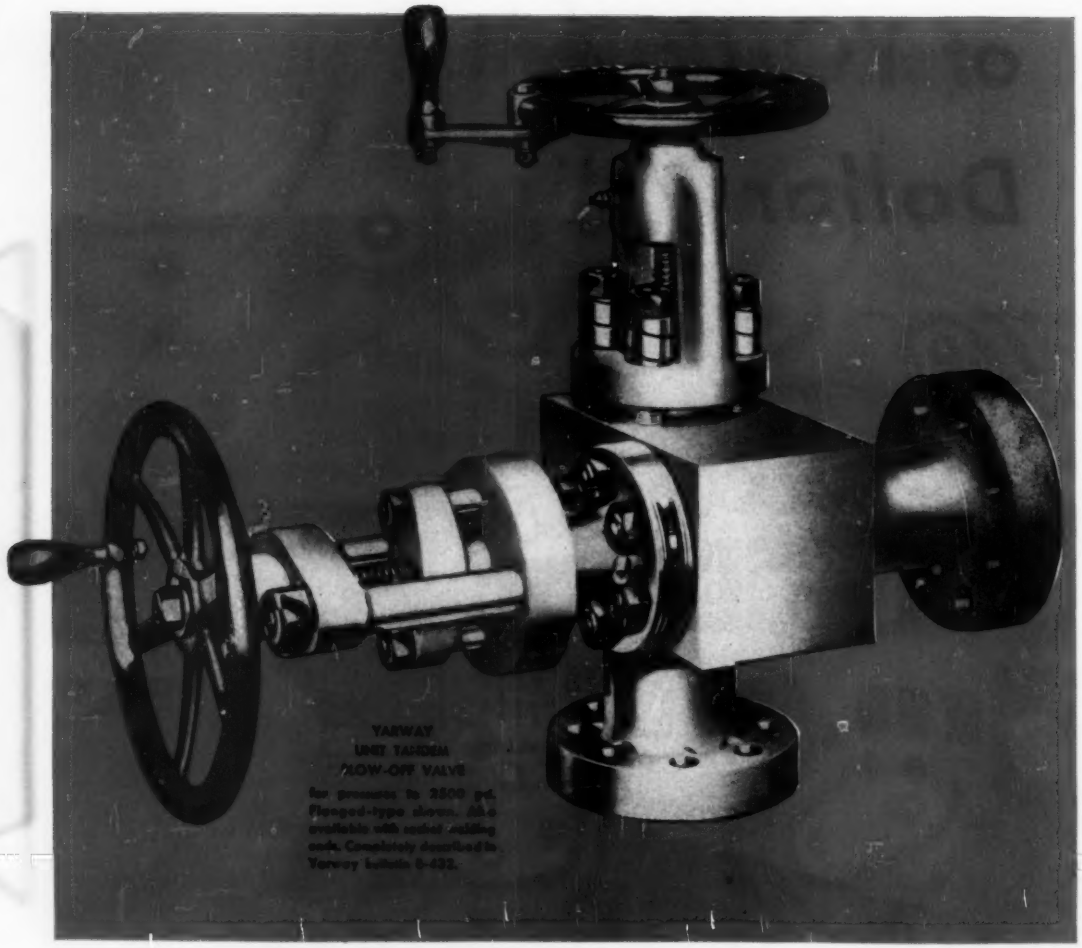


These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

YOUR BOILER



YARWAY

IS WORTH A *GOOD* BLOW-OFF VALVE

Boilers represent sizable investments . . . certainly worth protecting with the most dependable boiler trim you can get.

You need good blow-off valves—valves that keep blow-down lines tight, don't wear, clog or leak, and are rugged enough to stand up under the severe shock of regular or emergency blowing-down under pressure.

Yarway Blow-Off Valves meet those requirements. Both Yarway Seatless Valves with balanced sliding plunger, and Yarway Stellite-faced Hard-Seat Valves embody the most recent developments in design and metallurgy.

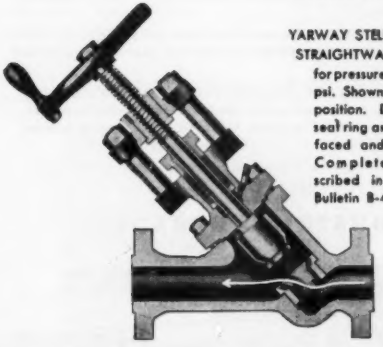
Engineers tell us the sturdiest of all blow-off valves is the Yarway Unit Tandem. This famous valve combines either a seatless and hard-seat, or two hard-seat valves, in a one-piece forged steel body. It is made for pressures up to 2500 psi. Other Yarway Blow-Off Valves meet lower pressure requirements.

It is significant that more than 15,000 plants throughout the world use Yarway Blow-Off Valves . . . and among the higher pressure plants, 4 out of every 5 are Yarway-equipped!

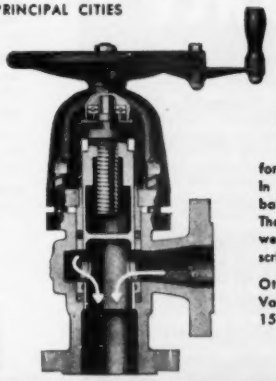
A Yarway bulletin will tell you in detail how these valves can protect *your* boiler investment. Write today, stating pressure range.

YARNALL-WARING COMPANY, 100 Mermaid Avenue, Philadelphia 18, Pa.

BRANCH OFFICES IN PRINCIPAL CITIES



YARWAY STELLITE-SEAT STRAIGHTWAY VALVE for pressures to 2500 psi. Shown in open position. Disc and seat ring are stellite-faced and ground. Completely described in Yarway Bulletin B-432.



YARWAY TYPE "B" SEATLESS ANGLE VALVE for pressures to 400 psi. In open position. Notice balanced sliding plunger. There is no seat to score, wear, clog or leak. Described in Bulletin B-424.

Other Yarway Seatless Valves for pressures to 1500 psi.

JOB PROVED

SUN PRODUCTS OFFER YOU "JOB PROVED" PERFORMANCE

Sun's wide selection of "Job Proved" petroleum products, plus the vast experience of Sun Engineers, can help you cut costs, step up production, and improve quality. Every Sun product, after its development in the laboratory, must pass rigid and exhaustive tests in actual use. When the worth of the product has been completely demonstrated in this way, then—and then only—it is given the "Job Proved" stamp and offered for sale. Detailed product information and the help of Sun Engineers are yours for the asking. Call your local Sun Office.

SUN OIL COMPANY
PHILADELPHIA 3, PA.
Sun Oil Company Ltd., Toronto and Montreal

INDUSTRIAL OILS

Original charge of Sunvis as good as new after three years' use in hydraulic press.

SUNVIS 900 OILS—Unexcelled for turbine lubrication, for use as a hydraulic medium, for circulating systems and similar applications requiring longest possible oil life, plus maximum protection to equipment. Sunvis 900 Oils have a high viscosity index and uniform 0°F. pour point, and are fortified against corrosion and oxidation.

SUNVIS OILS—Give long, trouble-free service in all types of industrial reservoirs and circulating systems operating at normal temperatures. Sunvis Oils have uniform high viscosity index, low pour point, and low carbon content.

SUNVIS H.D. 700 OILS—For internal combustion engines operating under heavy-duty conditions, or where hydraulic valve-lifters are used; for circulating systems and other industrial applications where contamination is a factor. The additives in Sunvis H.D. 700 Oils supply detergency, and minimize oxidation and corrosion.

SUNVIS 800 OILS—Special heavy-duty lubricating oils used in railroad diesel engines equipped with silver-alloy bearings.

SUNVIS 2200 AND SUNVIS 2300—Heavy-Duty Supplement #1 and Supplement #2 quality oils respectively. For use in diesel engines where high-sulfur fuels may be encountered.

DYNAVIS OILS—For internal combustion engines operating at moderate loads and speeds. These low-pour-point, high-viscosity-index, inhibited oils help prevent formation of harmful corrosive and sludge-forming acids.

CIRCO OILS—Straight mineral oils for general lubrication of industrial machinery. Unsurpassed for once-through applications, regardless of operating temperatures.

SUNTAC OILS—Recommended for general lubrication of all machines subjected to sudden shocks and load reversals. Compounded to increase adhesiveness, Suntac Oils cling to bearing surfaces and supply constant, superior lubrication.

STEAM CYLINDER OILS—Lubricants of high flash and fire point for saturated or superheated steam conditions and for worm gear speed-reduction units.

SUNOCO WAY LUBRICANT—Eliminates "stick-slip" of tables and scoring of ways. Noncorrosive, with outstanding metal-wetting and adhesive properties, ample viscosity and E.P. qualities. Approved by 36 leading machine tool manufacturers.

ROCK DRILL OIL—High-film-strength oil for use in jackhammers, stopers, drifters, and similar equipment.

INDUSTRIAL GREASES

Sun grease increases steel mill production by cutting bearing failures 93%.

SUN GUN GREASES—Smooth greases made with medium-viscosity oil. Stable under pressure in power and booster guns.

"JOB PROVED" IN EVERY INDUSTRY

SUN

SUN ADHESIVE PRESSURE GREASES—Won't drip or splash. Excellent lubricants for open-gear applications.

SUN DARK PRESSURE-SYSTEM GREASES—For power-driven central grease lubricating systems in heavy industries. Also used as "medium cup greases."

SUN MINE CAR GREASES—Available in several grades. Suitable for both antifriction bearings and plain-bearing cavity-type wheels.

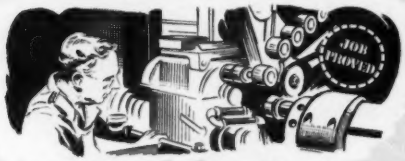
SUN MINING MACHINE LUBRICANT—Semifluid. For use where a light but adhesive grease is required. Resists separation and decomposition.

SUN ROLLER BEARING GREASES—For use on electric motors and generators and high-temperature machinery equipped with ball or roller bearings.

SUN GEAR COMPOUNDS—Black adhesive open-gear compounds and wire-cable greases. Recommended for power presses, mining machinery, worm reduction mills, crushers, pump gears, etc.

SUNOCO TRACTOR ROLLER COMPOUND—For crawler-type tractors. Provides good lubrication with exceptional sealing qualities.

METALWORKING OILS



Ball bearing manufacturer finds that Sunicut increases tool life 15%, eliminates sludging.

SUNICUT—Straight (non-emulsifiable) transparent cutting oils. Various grades for automatic screw machines and heavy-duty machining operations. Permit high speed production with excellent finishes, long tool life.

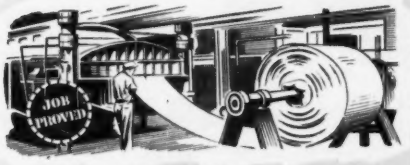
SUNOCO EMULSIFYING CUTTING OIL—An emulsifiable oil which produces a stable white emulsion. Efficient and economical cooling and lubricating medium for turning, milling, drilling, and other metalworking operations on both ferrous and nonferrous metals. It is also an excellent grinding coolant. Available in heavy-duty grades too.

SUN QUENCHING OILS—Specially refined oils designed to aid development of maximum physical properties in a wide variety of steels.

SUN TEMPERING OILS—Specially refined oils for tempering steel. Because of their low carbon content and stability under heat, these oils have an unusually long service life.

SUN ROLLING OILS—Straight and emulsifying oils which will permit maximum production in rolling steel, aluminum, brass, and copper.

RUBBER-PROCESS AIDS



Two Sun rubber-process aids save manufacturer $6,000 a year by taking the place of five competitive products.

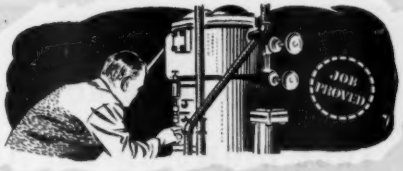
CIRCOSOL-2XH—An elasticator and process aid for natural rubber and especially for GR-S. Outstanding for sponge rubber.

CIRCO LIGHT PROCESS-AID—A processing agent and excellent softener for natural rubber, natural rubber reclaims, and neoprene synthetic rubber. Used for GR-S to some extent.

SUNDEX-53—An inexpensive product suitable for processing GR-S and blends of GR-S and natural rubber. An established process aid for rubber footwear stocks and semihard rubbers.

CIRCOMAR-5AA—A dark-colored product for processing natural and GR-S rubber used in tire-making. Also used in reclaiming natural-rubber scrap. Replaces asphalt fluxes. Free-flowing at room temperature.

REFRIGERATION OILS



Hotel turns to Suniso for its ice-making equipment; eliminates separation troubles, cuts oil costs 20%.

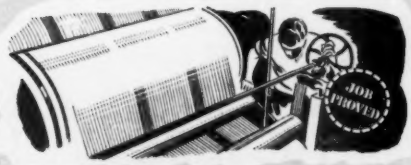
SUNISO REFRIGERATION OILS—High-quality oils having extremely low pour points, extremely low wax-separating characteristics, a high degree of stability, and long life. Initially neutral and resistant to formation of detrimental acids. Suniso grades are available to meet all low, normal, and high temperature conditions. The most widely used oils in refrigerating and air-conditioning.

SUNOCO WAXES

Waxes, "tailor made" to provide the exact properties demanded by different industries, are now available from Sun's new multimillion-dollar wax plant. Revolutionary manufacturing methods make it possible to retain only the wax portions desired for a particular use, while discarding those which might be detrimental.

Sunoco Waxes are precision-controlled for quality and uniformity of all physical and chemical characteristics important to the user. The various grades of Sunoco Wax are recommended on the basis of their ability to give superior performance on the specific job.

TEXTILE OILS



Sunotex replaces three formula components in textile mill; also saves 25% on costs.

SUNOTEX TEXTILE-PROCESS AIDS—Designed to impart desired additional properties to various fibers during their processing from the raw state into a manufactured product. All Sunotex textile-process aids are emulsifiable in water. Highest rating in Fade-Ometer tests.

SUN COTTON CONDITIONERS—Processing materials which prevent waste by cutting down excessive amounts of fly (fine air-borne lint particles).

SUN ASBESTOS FIBER CONDITIONER—Sprayed on asbestos during processing to keep fibers from being damaged or broken down. Harmful dust is minimized when this product is used.

SUN CORDAGE OILS—Generally used alone, but adaptable to various formulas used by cordage manufacturers. Selected products, highly compatible with additives.

SUNOTEX MACHINE OIL—One lubricant for nearly every kind of textile machine. A high-quality mineral oil and additive combination which prevents rust, clings to moving parts, and minimizes wear. Scours out of all kinds of fabrics easily and completely.

ADDITIONAL INDUSTRIAL PRODUCTS

SUN SOLVENTS—Sun Spirits for the thinning of paints, varnishes, and enamels, for metal-cleaning, and certain types of processing and extraction . . . a pure, water-white petroleum solvent free of corrosive sulfur. Other Sun solvents with special properties are available for the chemical industry.

SUN LEATHER OILS—Petroleum-base leather oils. Used for obtaining the desired tensile strength, proper temper, and controlled moisture content. Maintain a light even color, mix well, and distribute evenly.

INDUSTRIAL PRODUCTS

SUNOCO

"We don't have any more needless fuse blows on our Air Compressor circuit since we installed FUSETRON dual-element FUSES"

"Prior to the time we installed Fusetron fuses to protect the circuit feeding the 125 h.p. 220 volt, 3 phase motor on our air compressor we were troubled with fuses blowing needlessly.

"On an average of once every two weeks one of the 400 ampere, 250 volt renewable fuses protecting the circuit would open on the starting current of the motor.

"About May of 1947 we replaced the fuses with 400 ampere Fusetron fuses. Since then we have not had the circuit down once because of a needless blow."

Leon C. England.
Chief Electrician
Link Belt Company
Indianapolis, Ind.

Fusetron DUAL ELEMENT Fuses

give 10-Point Protection

1. ★ Protect against short circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

★ Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

Act on the Facts

Don't risk losses in your plant

One **needless** shutdown,
One **lost** motor,
One **destroyed** panel or switch,
One **burned out** solenoid—

May cost you more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

But, simply knowing that FUSETRON fuses do save money is knowledge — but it isn't action.

By passing the word along that all purchase and stock records should call for FUSETRON dual-element fuses, you have action that begets money saving.

What is the FUSETRON Dual-Element FUSE?

A fuse link combined with a thermal cutout—the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses, FUSETRON Fuses fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name_____

Title_____

Company_____

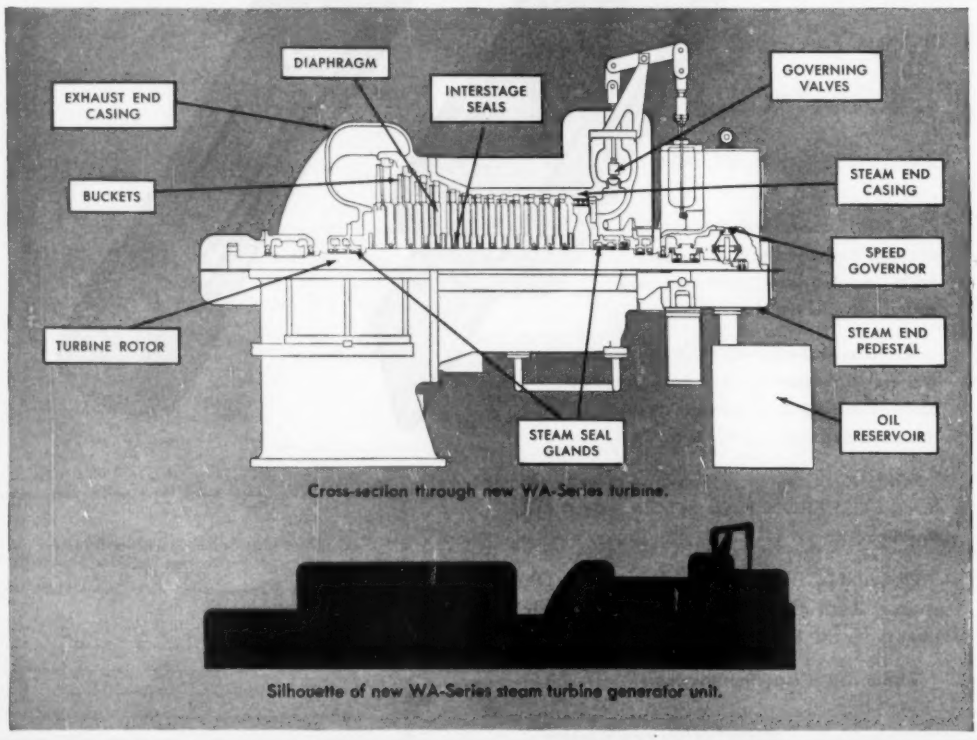
Address_____

City_____ State_____ 151

Allis-Chalmers

the WA

A Fully Modern Turbine Generator



Cross-section through new WA-Series turbine.

Silhouette of new WA-Series steam turbine generator unit.

Announces...

Series

Line of Steam Units; 500-7500 Kw

NOW IN PRODUCTION at Allis-Chalmers is the WA-Series of all-impulse steam turbine generators . . . embodying the most recent design developments! This series covers NEMA ratings in the range from 500 to 7500 kw inclusive. They are being built for both condensing and non-condensing service, with or without automatic extraction.

The WA-Series brings to the industrial and utility power plant the economies of repetitive manufacture as well as the design refinements proved in the larger units. The WA-Series incorporates flexibility of design to meet a wide variation of application requirements.

This modern design combines the very newest developments in impulse turbines and self ventilated generators. Allis-Chalmers—builder of steam prime movers for over 80 years and turbine builder for nearly half a century — has units of all types, and up to 150,000 kw in service.

The WA-Series units are functionally attractive and will be the central feature of any power plant. Turbine, generator and exciter are all especially engineered to operate together. The entire unit is designed, manufactured, assembled, and tested under one supervision at one plant.

For top performance in generation, with or without the economies of by-product steam, investigate the features of the new WA-Series. Be sure your next turbine generator has *all* the latest features!

Contact your nearest Allis-Chalmers office for full information on the advantages a WA-Series 500 to 7500 kw turbine generator will bring to *your* power plant. Main offices at Milwaukee 1, Wisconsin.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

TURBINES & GENERATORS • CONDENSERS & PUMPS • MOTORS & CONTROL
SWITCHGEAR & BREAKERS • TRANSFORMERS • WATER CONDITIONING

World's Widest Range of Power Plant Equipment

A-3233

vision – with a past,

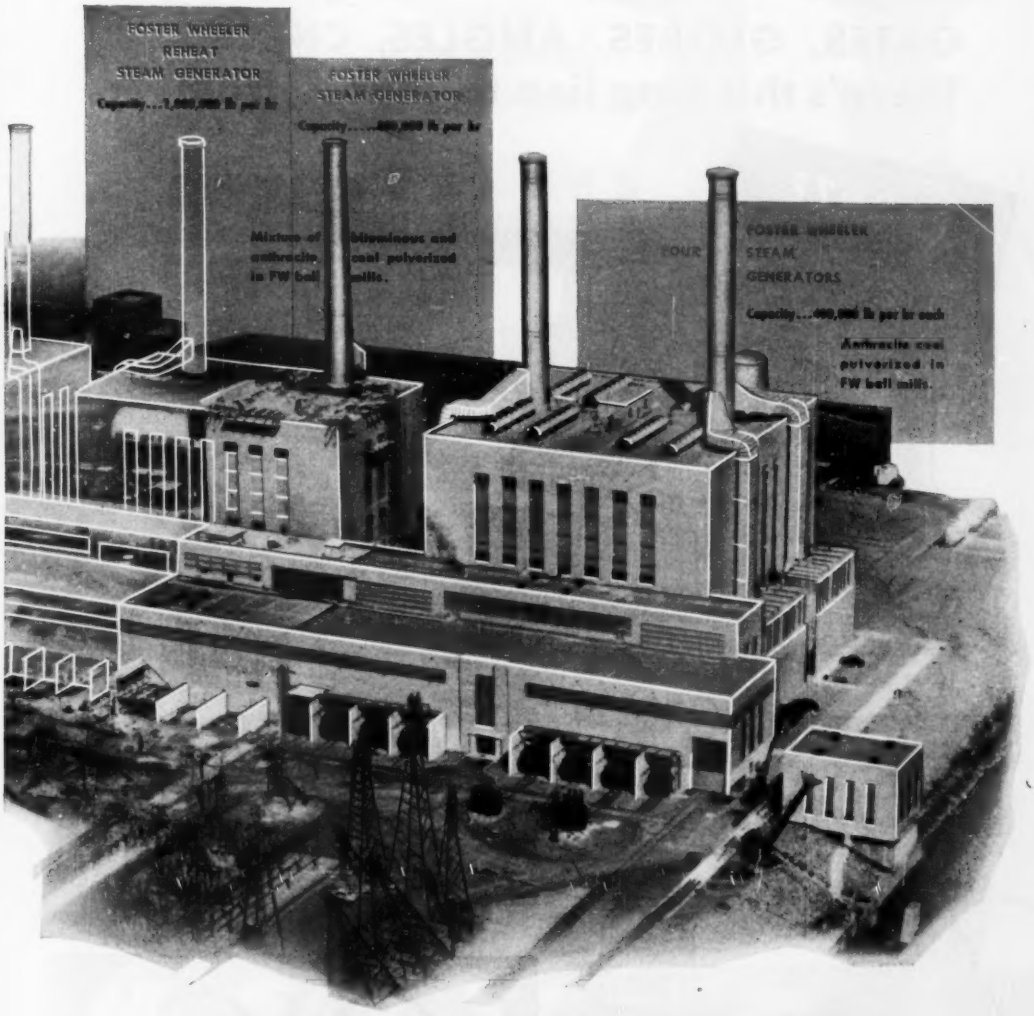
The original Sunbury Steam-Electric Station which was built by Thomas A. Edison in 1883.

The vision began to take form on Independence Day, July 4, 1883 at Sunbury, Pa. when Thomas A. Edison threw the switch of the first commercial steam-electric station in the world. This was one of the epochal events foreshadowing the scientific, industrial, and economic miracles of the 20th century. The new Sunbury Steam-Electric Station near Sunbury, Pa. reflects both the tradition of our American past and the hope of tomorrow as its fine buildings emerge from the blueprint stage to provide an abundant source of power for factories, offices, farms, and homes in Central Eastern Pennsylvania.

The earliest section which houses four Foster Wheeler 400,000 lb per hr steam generators providing steam for two 75,000 kw turbine generators is the world's largest power plant burning pulverized anthracite. The first extension houses a 100,000 kw turbine generator and an 800,000 lb per hr Foster Wheeler steam generator. Engineering is under way for the installation of an additional Foster Wheeler 1,000,000 lb per hr reheat steam generator designed to serve a 125,000 kw unit. When ultimately completed, the station is expected to have a capacity of more than 700,000 kw.

FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW

present, and future



YORK 6, N. Y.

FOSTER WHEELER

OIC FOR

GATES, GLOBES, ANGLES, CHECKS
There's this long line to choose from . . .

BRONZE

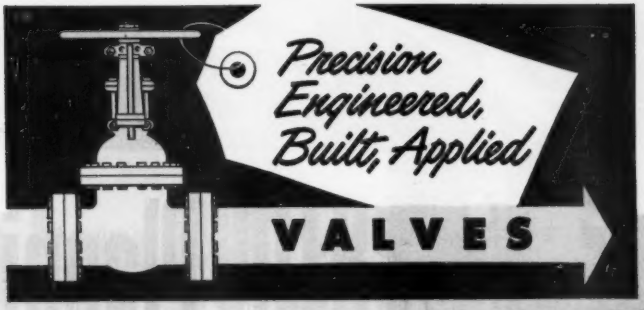
⅜-inch to 3-inches
125S, 150S, 200S, 300S, 350S, 300A, 200, 400, 2000 & 2500WOG.

IRON

1¼-inch to 16-inches
125S, 150S, 250S, 175, 200, 400 & 500 WOG.
CLIP GATES—¼-inch to 4-inches.

OIC
FOUNDED 1883

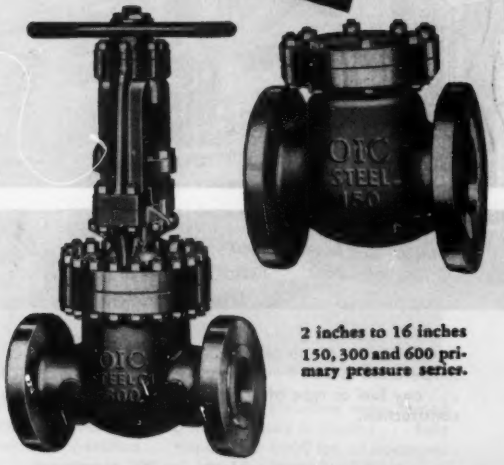
ANY VALVING REQUIREMENT



FORGED STEEL

¼-inch to 2-inches
600 primary pressure series.

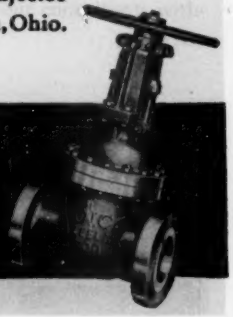
CAST STEEL



2 inches to 16 inches
150, 300 and 600 primary pressure series.

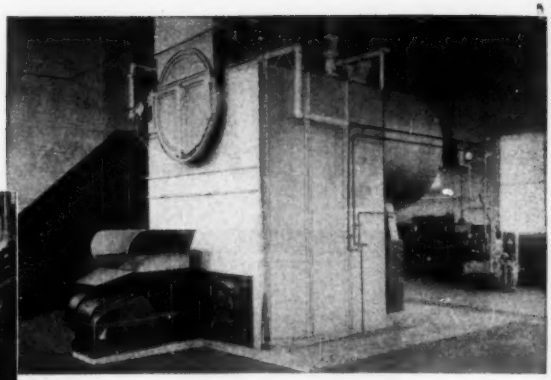
Screwed, flanged, butt weld and socket weld ends . . . rising and non-rising stems . . . outside screw and yoke . . . alloy metal seats, discs and wedges, composition discs . . . union, inside screw and bolted bonnet . . . tapered and parallel seat wedges.

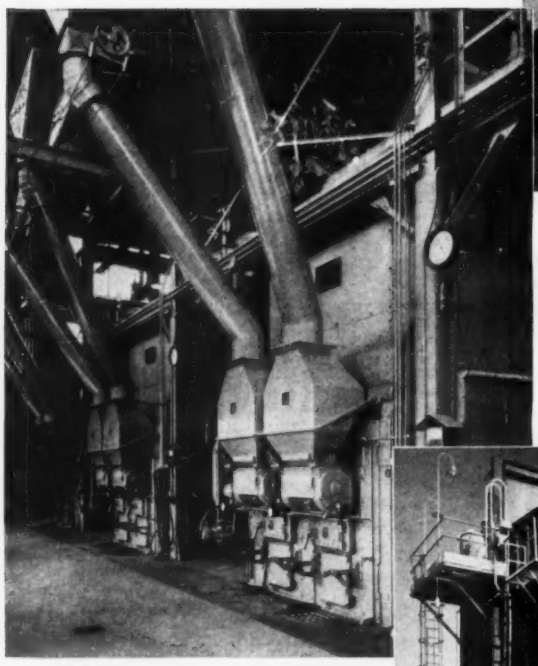
If you're needing valve application know-how, call the nearby OIC distributor or write direct to us. The Ohio Injector Company, Wadsworth, Ohio.



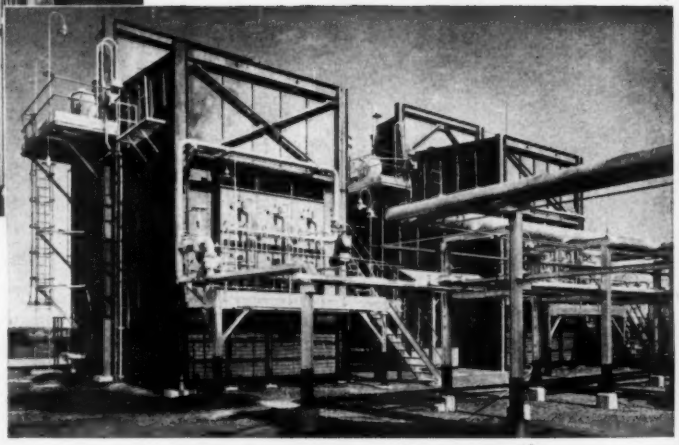
VALVES

FORGED AND CAST STEEL • IRON • BRONZE





Planning



Installation for medium and smaller plants . . . pressure to 475 psi . . . capacity to 60,000 lbs. of steam per hr . . . suitable for any type of fuel.

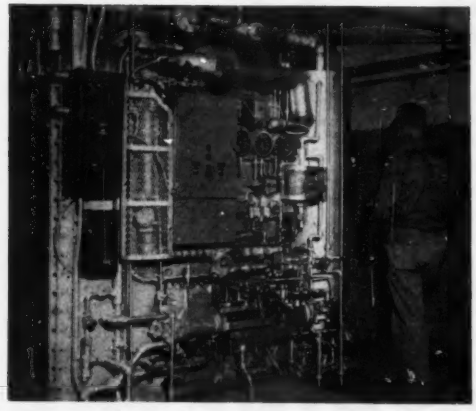
Installation for larger plants . . . pressure to 1000 psi . . . temperature to 900 F . . . capacity to 350,000 lbs. per hr . . . any fuel or type of firing . . . indoor or outdoor type construction.

COMBUSTION ENGINEERING

A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY

Installation for small plants . . . pressure up to 150 psi . . . capacity to 12,000 lbs. of steam per hr . . . adaptable to any fuel.

to buy BOILERS ? . . . this year



Installation for special conditions including very limited space . . . quick steaming (full capacity in 3 min.) . . . fully automatic operation . . . capacity to 6000 lbs. of steam per hr . . . pressure to 300 psi. Ideal for intermittent load.

Sometime this year, or perhaps next, your company may decide to buy new boilers . . . to replace obsolete units . . . to meet increasing steam demands . . . or for a new plant. Whatever the time or circumstances, here's something it will pay you to remember. With fuel and operating costs firmly established at new high levels, today more than ever before, the first cost of a new boiler is decidedly secondary to the annual operating cost. In fact, the annual cost of fuel alone for the average boiler installation nowadays usually equals or exceeds the purchase price. And the normal life of a boiler should be 20 to 30 years, or longer.

Obviously, then, the operating economies accruing from better design, construction or application, will quickly offset the difference between the cheapest boiler you can buy and the best the market affords. Here is one case where the old adage "the best is the cheapest" really applies.

In addition to having installed thousands of industrial boilers . . . in every size category from less than 100 horsepower up . . . Combustion has designed and built many of the country's largest utility power station boilers. And it is in this field — the manufacturing of power on a large scale — that boiler design and construction are evaluated most critically and exhaustively.

The fact that C-E Boilers have been selected to meet the exacting performance standards of so many of the nation's largest utility power stations is evidence of the quality of design and construction you can expect to find in any boiler, large or small, that bears the Combustion nameplate.

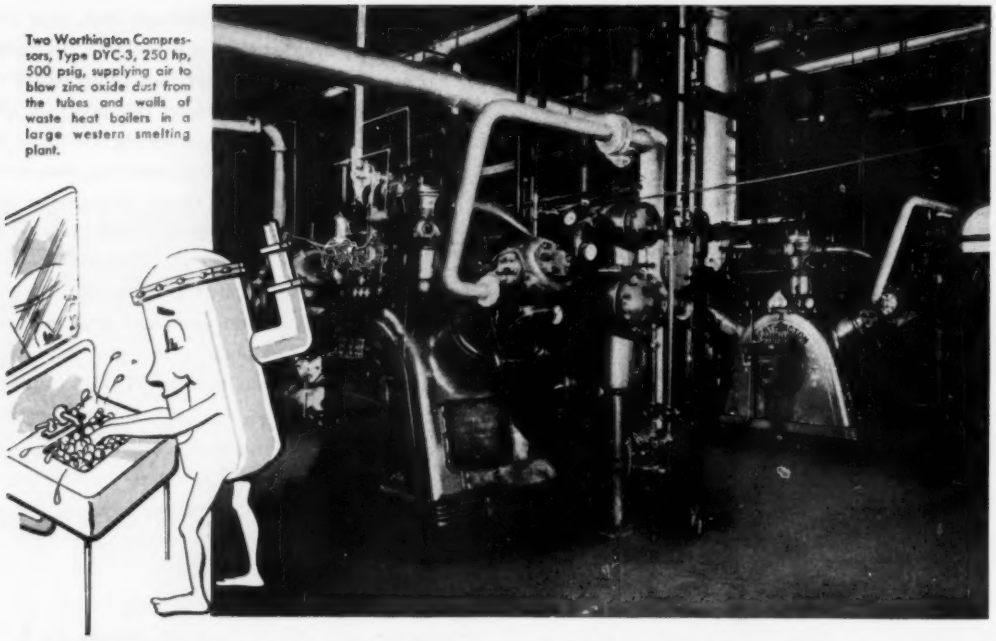
Our recommendations as to the most suitable type of boiler and firing equipment for the *specific requirements* of your next installation are available to you and your consultants without obligation.

B-383A

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E



Two Worthington Compressors, Type DYC-3, 250 hp, 500 psig, supplying air to blow zinc oxide dust from the tubes and walls of waste heat boilers in a large western smelting plant.

HOW TO DO A REAL SOOT-BLOWING JOB

... faster, better, at less cost!

Worthington Compressors Offer The Modern, Money-Saving Way To Make Your Boilers "Come Clean!"

Boiler cleaning by hand is a messy, makeshift carry-over from the horse-and-buggy era. Today, soot-blowing by compressed air is an economic necessity. Originally developed for low pressure boilers, air soot blowing has shown so many advantages over steam as a cleaning agent that its use has now extended to central stations and big power plants throughout the nation.

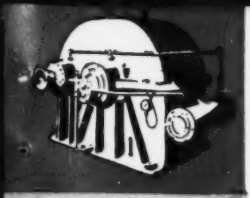
The reasons are plain. Air soot blowing saves fuel and feed-water make-up, while lessening the possibility of tube erosion. It uses inexpensive, low-temperature piping, with piping insulation eliminated. It reduces soot blower maintenance, provides a dryer blowing medium and a more effective means of slag removal. Finally, its complete adaptability to automatic control reduces costly manual operation throughout long years of service.

"Heart" Of Every Soot Blowing System

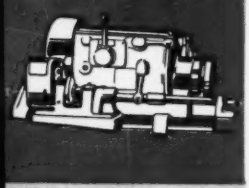
is its compressors . . . and Worthington builds these for every application . . . builds them to give you longer, quieter, smoother service — and air at lower cost. For further facts proving *there's more worth in Worthington*, write for booklet, "Worthington Compressors for Soot Blowing". *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, N. Y.*

KO-6

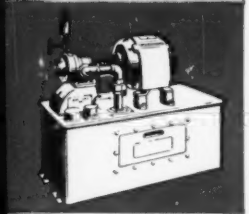
WORTHINGTON



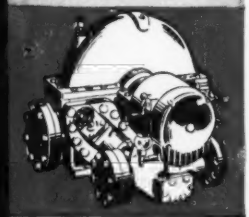
SPEED REDUCER



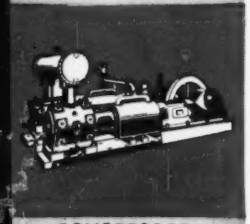
HEAD STOCK GEARS



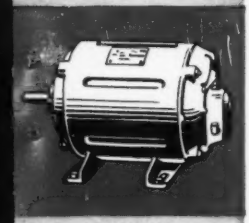
HYDRAULIC SYSTEM



AUXILIARY TURBINE



COMPRESSOR



MOTORS

Now better than ever

NEW

STANOIL
TRADE MARK
Industrial Oil

Brings two new benefits to wide range of jobs

For 14 years, STANOIL Industrial Oils have proved their ability to handle a wide variety of jobs in midwest plants. Now, these established products have been made better than ever! They offer these new and important savings in an even wider variety of industrial equipment.

1 LONGER OIL LIFE

Because they have greater oxidation stability, the new STANOILS stand up under high temperatures of operation, maintain low acidity for longer periods of service which helps keep oil systems free from deposits caused by oil oxidation.

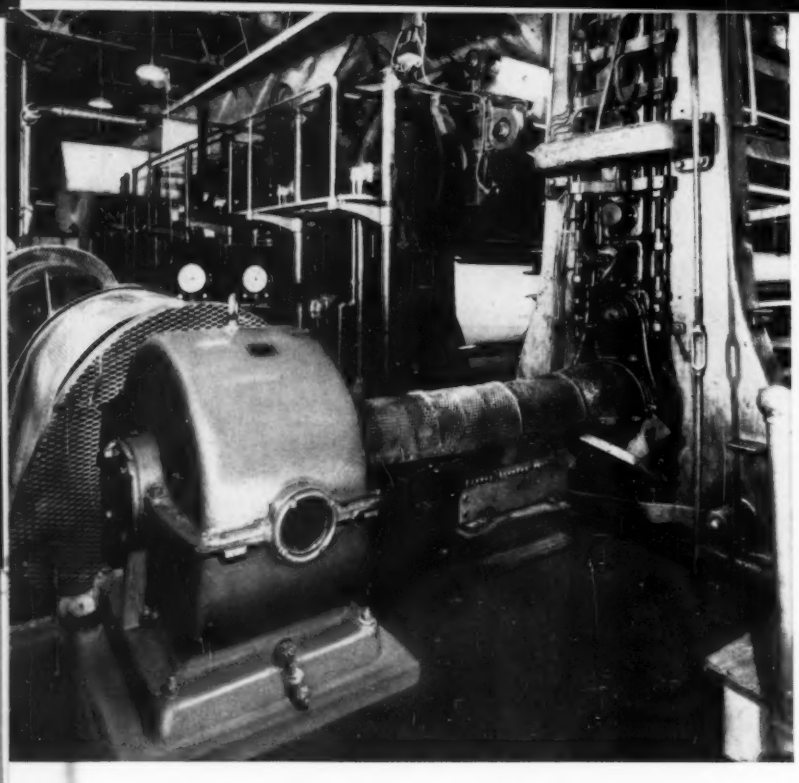
2 GREATER PROTECTION against RUST

A corrosion inhibitor of the most advanced type has been added to all grades of the new STANOILS that benefit by such an additive. This inhibitor prevents corrosion trouble by "plating out" on surfaces that tend to rust. In such severe service as paper-machine and steam-turbine lubrication, new STANOILS have put an end to rust and corrosion troubles!

At the left are shown several types of equipment in which the new STANOILS can save you money and maintenance time. A Standard Oil lubrication specialist will help you find still other applications where versatile STANOILS can replace many special-purpose oils. You can reach this man quickly and easily through your local Standard Oil Company (Indiana) office. Contact him today. Or, if you wish, write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

STANDARD



What's YOUR problem?

R. R. Rowlands of Standard Oil's La-Crosse, Wisconsin, office is the lubrication specialist who helped this midwest paper mill (see left) solve a serious problem by recommending STANOGEAR EP Lubricant.

Standard's lubrication specialists are located throughout the Midwest. One of them is within easy reach of your plant. You can contact him simply by phoning your local Standard Oil Company (Indiana) office. His experience and special training will help you get maximum benefits from STANOGEAR EP Lubricant and other outstanding products such as:

SUPERLA Greases—Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

STANOLITH Greases—Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

CALUMET Viscous Lubricants—On open gears and wire rope, these greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of gears, better lubrication of wire rope.

STANORUST Rust Preventives—The eight grades of STANORUSTS form one of the most complete and effective lines of rust preventives on the market today. Each has been scientifically and specifically developed for its intended use. The grades range from a fingerprint remover to a heavy grease type product that protects against corrosion for years under the most severe outdoor exposure.

Helps gear units keep their teeth...

HEAVIER LOADS and higher speeds brought trouble to 16 large gear units used for driving paper machines at a midwest paper mill. Under the more punishing conditions of temperature and pressure, the lubricant in the gear sets deteriorated rapidly and had to be replaced every three to four months. Of even greater concern to plant operators was the pitting of gear teeth surfaces—a real threat to uninterrupted operation of paper machines and to plant economy.

The problem was put to a Standard Oil lubrication specialist. He pointed out that the lubricant in use did not have the extreme-pressure characteristics necessary to maintain strong, protective films of oil in the face of high gear loads. Upon his recommendation, the gear cases were drained and cleaned, then filled with STANOGEAR EP Lubricant.

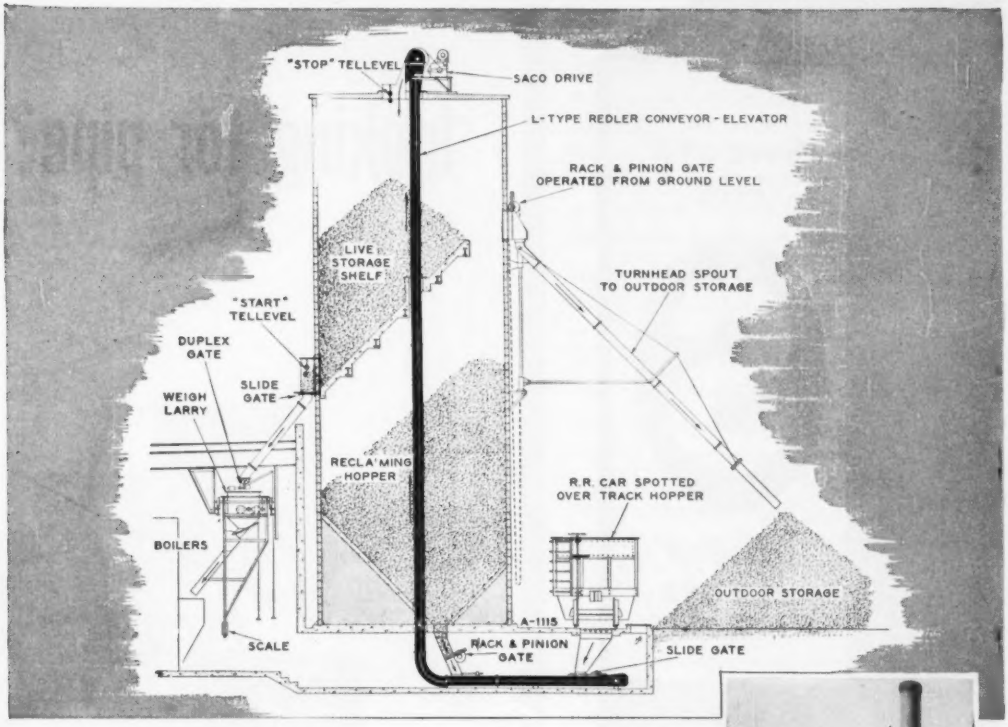
In two years of continuous operation—24 hours a day and 6 days a week—the original fills of STANOGEAR EP have shown no appreciable deterioration and have not needed to be replaced. Plant officials report that the gears show no measurable wear, that pitted surfaces are polished and in excellent condition, and that gear cases are clean.

STANOGEAR EP
REG. U. S. PAT. OFF.
Lubricant

Why not utilize the Standard Oil service employed so successfully by this company? The combination of expert engineering and high quality products can help you solve a specific problem or gain greater all-around economy. How you can put this service to work for you, quickly and easily, is explained at the right.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD **STANDARD OIL COMPANY (INDIANA)**



UP goes coal DOWN come costs!

Twenty tons of coal per hour—stored and reclaimed as needed—that's the day-in, day-out performance of this REDLER conveyor-elevator, *engineered for the job* by Stephens-Adamson. For fifty years S-A has been designing and installing coal and ash handling equipment. In every field of industry S-A engineering is proving outstanding superiority *on the job*—with maximum efficiency and minimum costs! If YOU have a bulk material handling problem, you are invited to consult with S-A engineers—at once and without obligation.

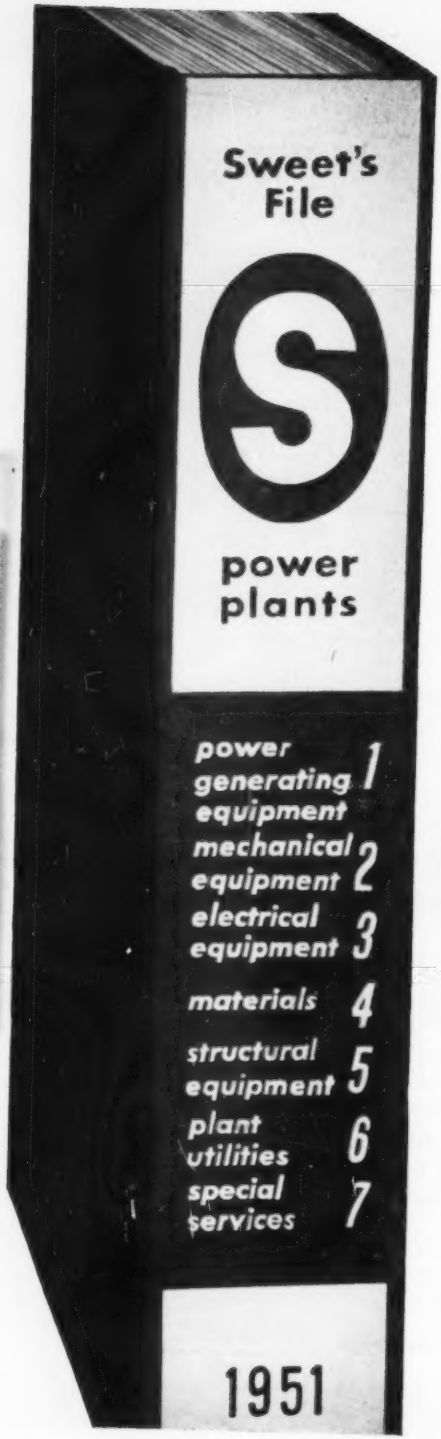
STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

THE BORDEN COMPANY
Clintonville, Wis.

Lower horizontal run of Redler picks up coal from under track hopper and curves into vertical run for elevation to discharge point at top of silo. When live storage shelf is filled, coal spills over into bottom of silo where it is reclaimed as needed. Coal on live storage shelf can be directed by a chute through roof of boiler house where a duplex gate discharges to an S-A weigh larry which can be moved to discharge into either of two boiler stokers. Tellevel storage control units regulate volume of coal in live storage.

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT



looking for pipe?

Sweet's

valves? controls?

catalog service

Reach for Sweet's... **All these manufacturers' catalogs—containing comprehensive information on pipe and fittings, valves and traps, measuring and controlling equipment—are instantly available in Sections 2d, 2e, and 2f of your Sweet's File for Power Plants.**

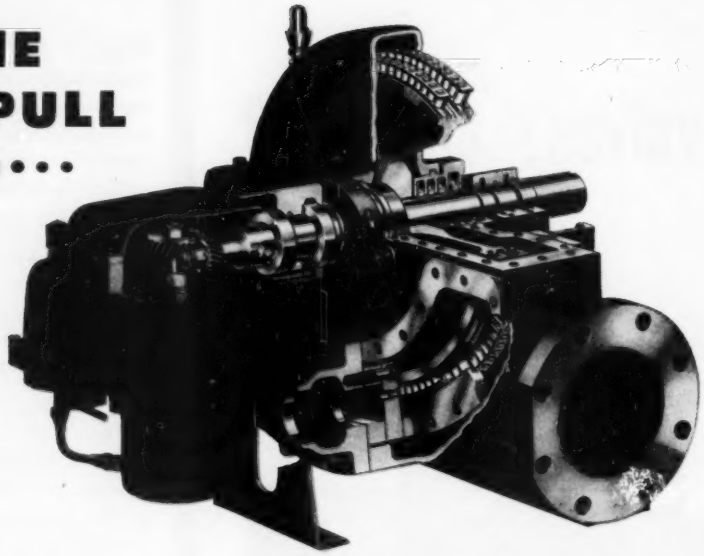
The other sections of this Sweet's File contain additional catalogs covering a wide range of materials and equipment . . . useful and up-to-date information on product forms, characteristics, performance and use.

This grouping of manufacturers' catalogs, in sections according to products or use of products, is made for your convenience, so that you can more readily compare one product with another. Indexes of manufacturers, products and trade names lead you quickly and easily to the catalogs you are looking for.

Sweet's is working constantly to get more manufacturers to send you their catalogs in this easy-to-use form. If you fail to find what you want, please tell us.

DIVISION OF F. W. DODGE CORPORATION 119 WEST 40th STREET NEW YORK 18, N. Y.

FOR THE LONG PULL AHEAD···



DRIVE RELIABILITY WILL

TYPE DP TURBINES

With American industry once more placing its major emphasis on increased production, plant equipment must be ready for severe tests. One of the sure ways of keeping output high is the use of production tools with high reliability records.

Reliability in equipment drives means more than just the initial ability to meet specified performance ratings. You want to rely on the drive for trouble-free service after months of continuous operation. You want accuracy and economy to remain high with no loss in production time for special maintenance.

If your plant uses turbine drives, select the mechanical drive turbine that's designed for dependability under all operating conditions—General Electric's Type DP. From the totally enclosed governor to the durable babbitt-faced bearings, DP construction will provide greater productivity through greater reliability.

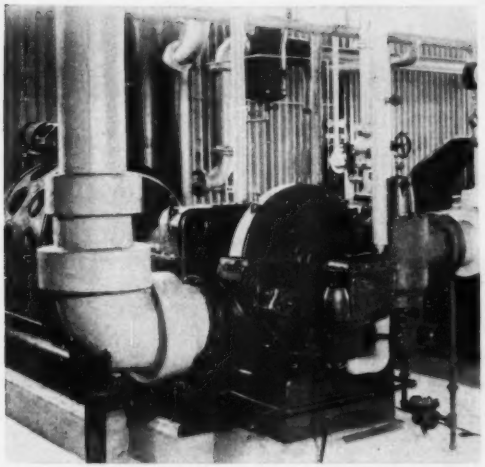
Totally Enclosed Oil Relayed Governing system has no mechanical linkages and few moving parts. It can't stick, gum or rust, even during long standby periods. You can always depend on the DP governor for accurate control over a 30% adjustable speed range.

Positive Lubrication adds years to the life of the turbine. Oil is fed under pressure to grooves in automotive-type, babbitt-faced bearings that also absorb shaft thrust and maintain accurate wheel clearance. A strainer assures that only clean oil is pumped to the bearings and governing system.

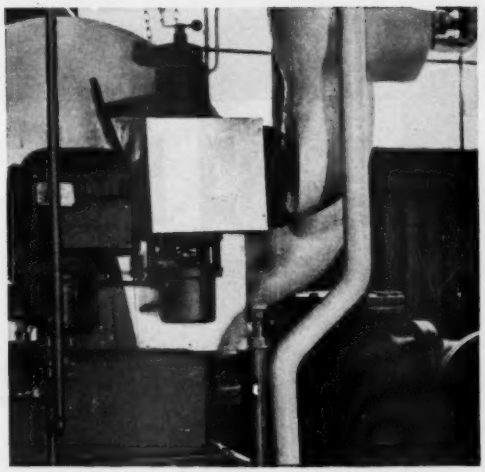
Rugged Construction and Quality Materials provide resistance to erosion and corrosion. Special steel nozzle plate, self-lubricating graphite packings, and Monel-sprayed shaft are examples of design features that keep parts replacement to a minimum.

Easier, Quicker Maintenance is part of the DP design. Standard parts are easily stocked for routine replacement. Disassembly is simplified by the use of socket-head cap screws throughout the turbine.

If you're not familiar with the DP turbine, why not write for a free copy of bulletin GEA-4955A. Or, if you prefer, call your nearest General Electric sales office: *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

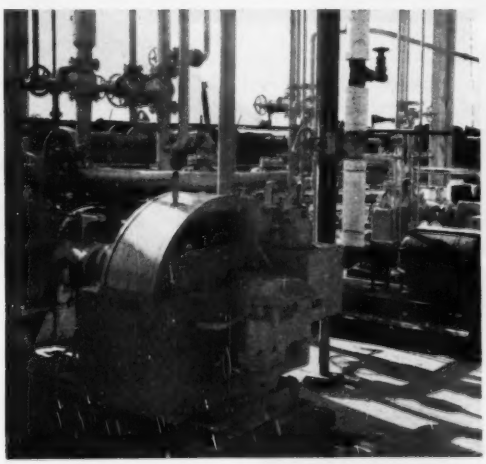


Here a 100 kw generator is driven through a gear coupling by a standard DP turbine. This kind of assignment requires accuracy and reliability such as you would expect only from much more expensive turbines.

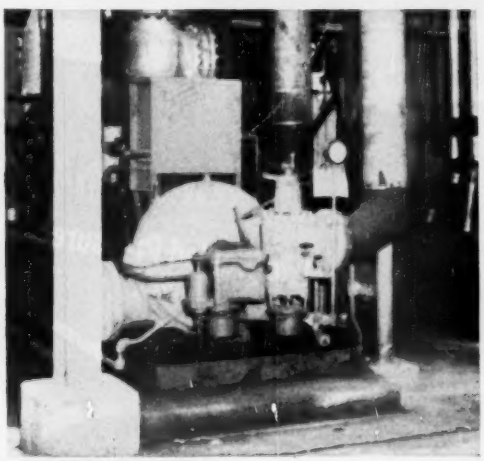


The DP turbine's totally enclosed governing system is always ready for immediate service—even after long periods of idleness. In this West Coast sawmill, DP's are used to drive standby fire pumps.

BOOST YOUR PRODUCTION



You can install the DP anywhere—indoors or outdoors—without fear of parts corrosion. This standard DP is driving centrifugal pumps in an outdoor refinery installation.



In this refinery, DP turbines drive pumps used in the catalytic cracking process. Since installation, the turbines have provided dependable service—essential for important, continuous processes.

DP stands for Dependable Power

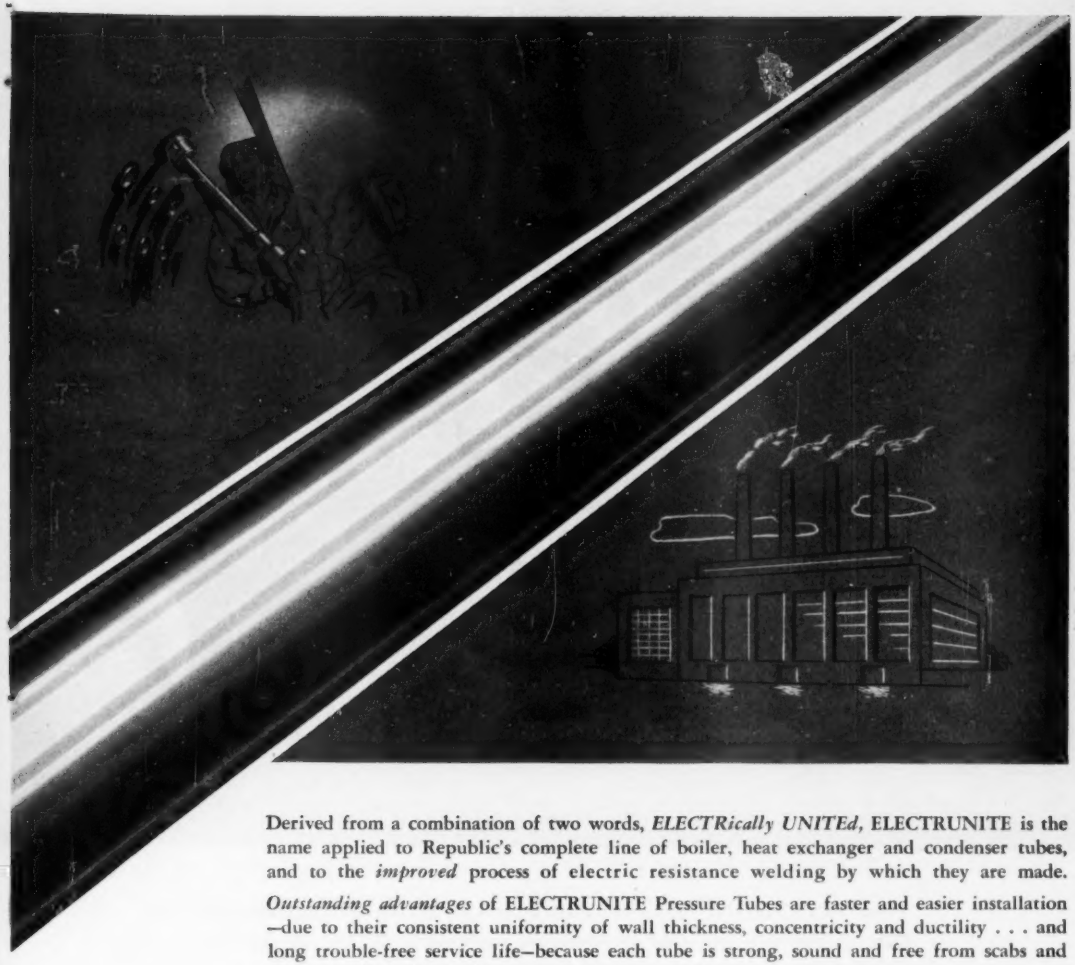
GENERAL ELECTRIC

252-48

ELECTRUNITE

means

ELECTRICALLY UNITED



Derived from a combination of two words, *ELECTRically UNITEd,* ELECTRUNITE is the name applied to Republic's complete line of boiler, heat exchanger and condenser tubes, and to the *improved* process of electric resistance welding by which they are made.

Outstanding advantages of ELECTRUNITE Pressure Tubes are faster and easier installation —due to their consistent uniformity of wall thickness, concentricity and ductility . . . and long trouble-free service life—because each tube is strong, sound and free from scabs and slivers, both inside and out.

In the past 15 years, more than 200,000,000 feet of *modern* ELECTRUNITE Pressure Tubes have been installed in countless types of steam generating and heat transfer equipment used throughout all industry. For complete information about the ELECTRUNITE Process and ELECTRUNITE Pressure Tubes, write for a *FREE* copy of Booklet BT-12.

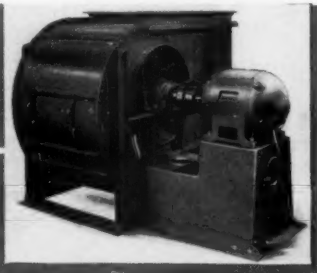
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

Republic
REPUBLIC STEEL
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

These two "Buffalo" Induced Draft Fans take it, day in and day out. Part of recently installed powerhouse equipment in the Bridgeville plant of the American Cyanamid Company.

LEFT, double width housing of "Buffalo" Induced Draft Fan with inlet box side sheet partially removed.

RIGHT, "Buffalo" double inlet Forced Draft Fan for small boiler installation.



"Buffalo"

FANS FOR THE POWER PLANT

AMERICAN CYANAMID

uses

"Buffalo" DRAFT FANS

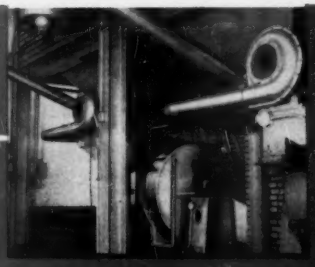
● "Buffalo" Mechanical Draft Fans are built to take punishment as well as to deliver efficiently. Well known for their convenient construction so that they can be easily serviced, they are equally recognized for their sturdy design and lack of vibration.

For "staying power" (and that's always the cheapest power), make "Buffalo" Fans your choice.

Write **FOR ENGINEERING BULLETIN 3750**

LEFT, "Buffalo" Primary Air Fan. Air is used to blow powdered coal into combustion chamber.

RIGHT, "Buffalo" Overfire Blowers supply air to improve combustion and prevent smoke.



BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

YOU CAN BE SURE.. IF IT'S
Westinghouse

NEW
Large Induction Motors Cut Maintenance Costs 2 Ways

Ease of inspection . . . low-cost maintenance stand out in industry's new large motor—the Westinghouse ***Type CSF.***

Heading the list of cost-cutting features are sectional construction of end covers and air shields. Gone is the need for overhead cranes and costly, time-consuming operations. There's no top half of the bracket to remove . . . only the top half of the bearing housing.

Sectional covers can be removed from both ends of the motor in a few minutes for complete inspection, cleaning and other servicing requirements. The rotor and brackets need not be disturbed.

Split-sleeve bearings and oil rings make inspection or replacement easy. Simply remove the bearing housing cap. Bearings can be removed and replaced, by hand, without disturbing the bracket mounting.

Permanently aligned bearings assure proper air gap. The bottom half of the bearing housing is integral with the bracket, which is accurately machined and held in perfect alignment by a rabbet fit on the stator.

Added to these outstanding advantages are many other features that tell you these motors are built to do your job best . . . at lower cost. Get the facts from your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.
J-21551

Westinghouse
LARGE INDUCTION MOTORS

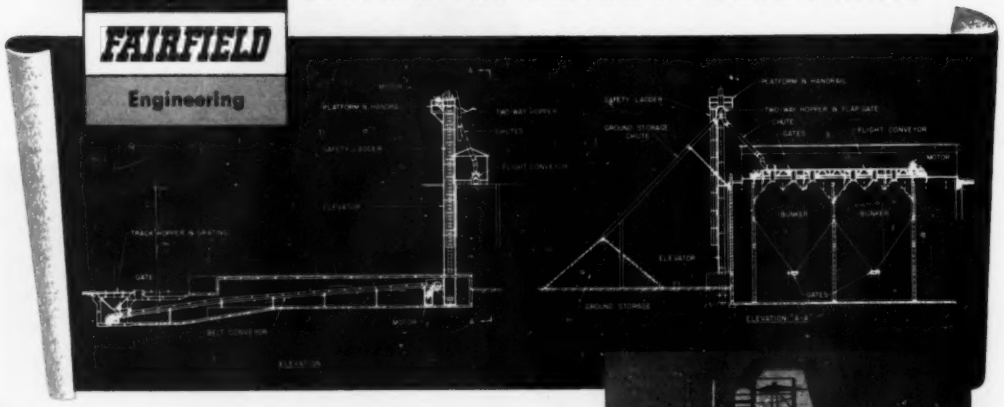
Westinghouse **Type CSF** *Motors are available, squirrel-cage or* **Type CWF** *wound rotor, in four types: drip-proof, outdoor, splashproof and totally-enclosed, fan-cooled—in frame sizes 30 and larger, 4 or more poles.*

Progressive

FAIRFIELD

Engineering

SERVING THE NATION'S POWER PLANTS



From Maine to California

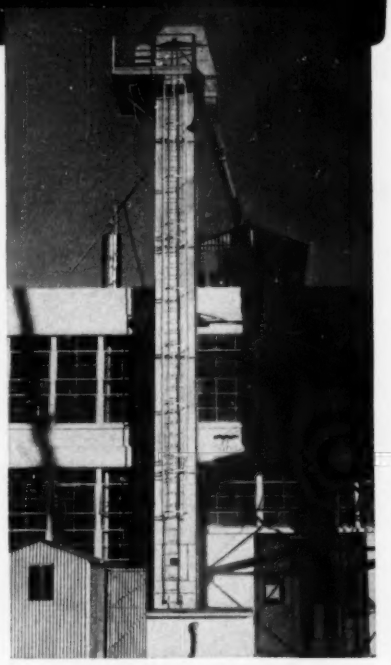
And all the stops between, there's a Fairfield Coal and Ash Handling System at work in the vicinity . . . providing efficient, low cost handling. One of the many reasons Fairfield equipment enjoys this wide-spread usage and its enviable reputation in the Power field stems from the fact that at Fairfield, 35 years of know-how engineering is applied to every job—large or small.

An example of the latter is illustrated here—a system for a creamery plant in Missouri. The same economical planning, survey, and engineering went into this installation that goes into Fairfield's largest power plant installations. For efficient, economical recommendations on your power plant operation, call in your Fairfield Engineer today.

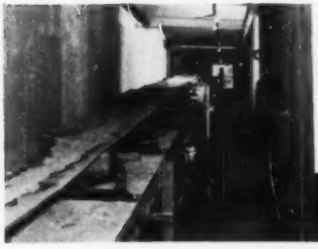
THE **FAIRFIELD**

ENGINEERING COMPANY

335 Chicago Ave. Marion, Ohio

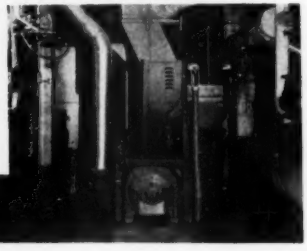


Centrifugal discharge type vertical Elevator provided with two-way discharge hopper for optional ground storage.

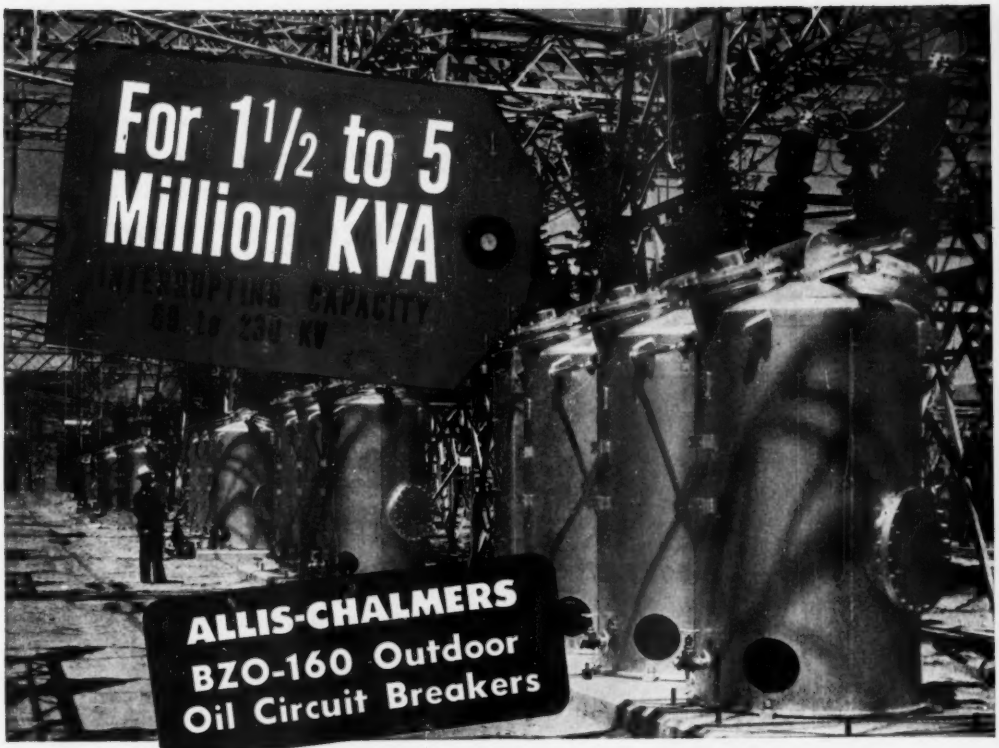


16" Belt Conveyor receives coal from track hopper regulating gate and delivers to elevator

Double strand type Flight Conveyor mounted over coal bunkers and equipped with discharge gates and chutes.



Steel hopper bottom type Coal Bunker fitted with drip and sift proof gates.



MECHANICALLY TRIP-FREE OPERATOR *affords high-speed opening*

RELIABLE HIGH SPEED FAULT CLEARING AND FAST RECLOSING *for system needs*

EVERY BREAKER COMPLETELY FACTORY ASSEMBLED AND TESTED *before shipping*

MAINTAIN continuity of power service despite transient line faults. The BZO-160 oil circuit breaker clears system faults in 3 to 5 cycles and recloses within 20 cycles to give you protection in ratings 69 kv and higher. Get long-life performance and reliable protection with these BZO-160 features:

1) Mechanically trip-free design gives high-speed contact opening under all operating conditions. Pneumatic operator is uncoupled from the contact mechanism through a positive mechanical linkage. This means that contacts open independent of closing piston position.

2) *Ruptor* interrupter gives split-second arc extinction . . . interrupts load and fault currents with low arc energy release. Reduces oil and contact deterioration to a minimum. Arc resistant alloy contact tips give long contact life with little maintenance.

The BZO-160 performance is based upon more than 50 years of circuit breaker design and manufacturing experience, exacting laboratory and field tests, and years of power service. Simple breaker construction, free of complicated mechanisms, makes inspection easy.

For more information on dependable BZO-160 performance call your A-C sales office or write for new bulletin 71B6022C. A-3074

ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

STANDARD RATINGS

Rated KV	Rated Amp. 60 cycle	KVA Interrupting Capacity*
69	1200	2,500,000
69	2000	3,500,000
115	800	1,500,000
115	1200	3,500,000
138	800	1,500,000
138	1200	3,500,000
138	1200	5,000,000
161	800	3,500,000
161	800	5,000,000
230/196	800	3,500,000
230/196	800	5,000,000
230	800	3,500,000
230	800	5,000,000

*For information on higher interrupting ratings, get in touch with your A-C sales office.

Ruptor is an Allis-Chalmers trademark.

ALLIS-CHALMERS

IT HAS BEEN AMERICAN BLOWER'S PRIVILEGE TO SERVE THESE AND OTHER PRODUCERS OF POWER IN THE PUBLIC UTILITY FIELD

Buffalo Niagara Electric Corporation
Central Arizona Power & Light Company
Central Illinois Electric & Gas Company
Central Illinois Light Company
Columbus & Southern Ohio Electric Company
Connecticut Light & Power Company
Consolidated Edison Company of New York
Consumers Power Company
Consolidated Gas, Electric Light & Power Co. of Baltimore
Connecticut Power Company
Dairyland Power Co-operative
Dallas Power & Light Company
Detroit Edison Company, The
Duke Power Company
Eastern Shores Public Service Company
Fitchburg Gas & Electric Light Company
Florida Power Corporation
Florida Power & Light Company
Gulf Power Company
Hartford Electric Light Company
Indianapolis Power & Light Company
Iowa Public Service Company
Iowa-Illinois Gas & Electric Company
Iowa Power & Light Company
Iowa Electric Light & Power Company
Kansas City Power & Light Company
Kansas Power & Light Company, The
Kansas Gas & Electric Company
Long Island Lighting Company
Los Angeles, California, City of
Louisiana Power & Light Company
Madison Gas & Electric Company
Mississippi Power Company
Missouri Power & Light Company
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Pennsylvania Power Company
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Potomac Electric Power Company
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Public Service Electric & Gas Company
Public Service Company of Colorado
Southwestern Public Service Company
Southern Indiana Gas & Electric Company
South Carolina Power Company
Springfield, Illinois, City of
Tampa Electric Company
Texas Electric Service Company
Texas Power & Light Company
Tennessee Valley Authority
Virginia Electric & Power Company
Worcester County Electric Company of Massachusetts

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

DRAFT FANS

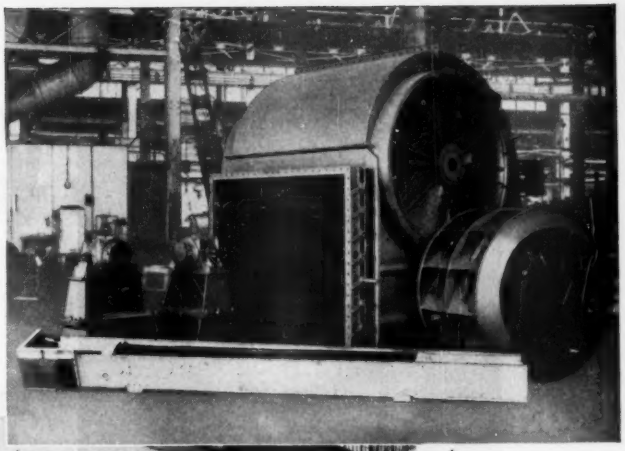
for

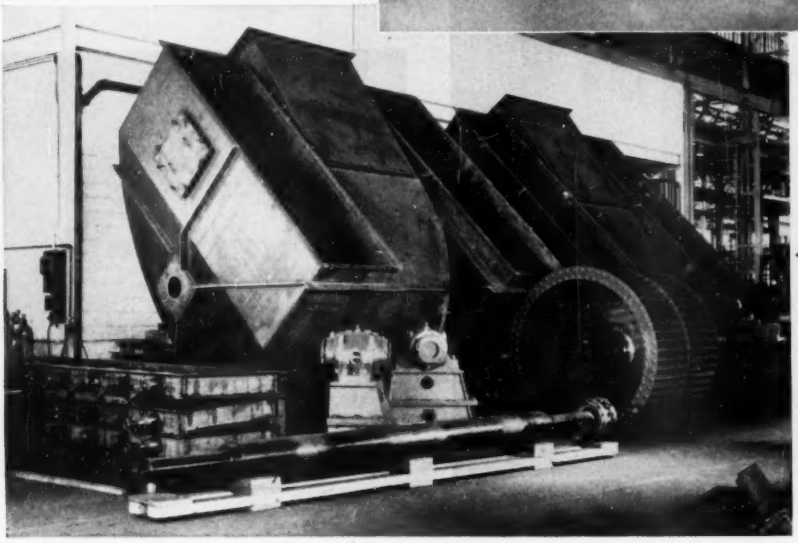
PACIFIC GAS & ELECTRIC CO.

Contra Costa Station at San Francisco

Bechtel Corporation, Engineers

To keep progress with ever-increasing demands for electrical horsepower, America's great public utilities are constantly expanding their plants and facilities and extending the scope of their services.





Above is shown one of the 6 American Blower Forced Draft Fans used on each boiler in the new Contra Costa Station. Each fan is 180,000 CFM at 100° at 18.2" static pressure.

The photograph at the left shows 2 of 6 American Blower Induced Draft Fans for the same station. Each has a capacity of 313,000 CFM at 420° at 10.1" static pressure. The new Contra Costa Station of the Pacific Gas and Electric Company will be used to supplement their very large hydro and steam generating electrical system.

That a vast majority of these utilities depend on us for important equipment, is a tribute to the fine performance of American Blower Products as well as to the engineering skill available through our strategically located branch offices.

May we serve you?

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

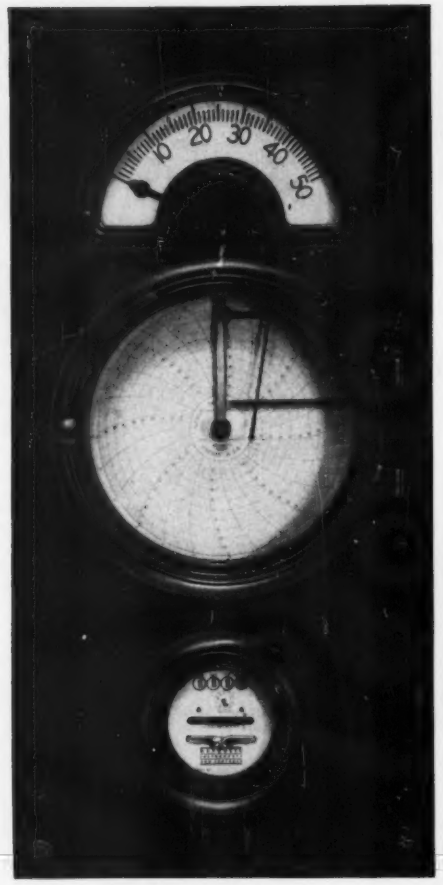
Division of American Radiator & Standard Sanitary corporation

You are extended a cordial invitation to visit our exhibit in Booth A if you attend the
Heating and Ventilating Exposition
in Philadelphia,
JANUARY 22-26, 1951.

YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

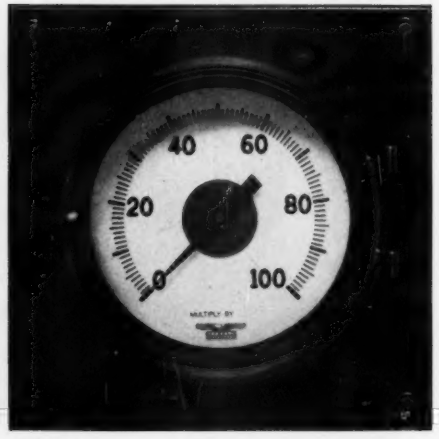
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



Indicator-Recorder-Integrator

Varying flows because the



Indicator

The Republic flow integrator, being of the modified watt-hour type, totalizes continuously —not intermittently. It operates independently of the recorder and its accuracy is not dependent on or affected by any clock mechanism or mechanical action.

The Republic meter is, on this account, peculiarly fitted to follow all changes in flow rate and accurately measure highly fluctuating flows.

ALL TYPES OF FLUIDS

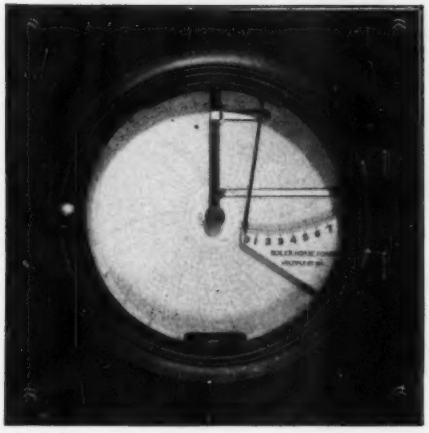
Republic electric type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 5,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator—are of the remote reading type and can be located any distance from the point of flow measurement.

ANY COMBINATION

While each Republic reading instrument is standard in design and construction each is especially calibrated for the particular flow measurement for which it is specified. Any reading instrument, indicator, recorder or integrator, may be obtained separately or in any

are accurately totalized

integrator is continuous



Recorder

Integrator

combination desired, making possible the highest degree of flexibility in plant use.

SIMPLE IN OPERATION

The Republic electric meter is the only flow meter commercially manufactured which is strictly electric in its operation. All other types of so called electric meters use the motion of the mercury to move a float or produce a force which is then converted into an electrical value which is in turn transmitted to a receiving or reading instrument. In the Republic meter, the transmitted electrical value is determined directly by the mercury motion, thus eliminating one of the steps in the sequence, and simplifying the mechanism to that extent. Their are no floats, levers, cams, rotating shafts or anything else to interfere with the unimpeded movement of the mercury, which has no work to perform, but merely fulfills the function of making contact.

NEW DATA BOOK

Just off the press—a completely new data book describing and illustrating, in detail, the operating features of the Republic Flow Meter and its many applications. Write for your copy of Data Book No. 702—there is no obligation.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

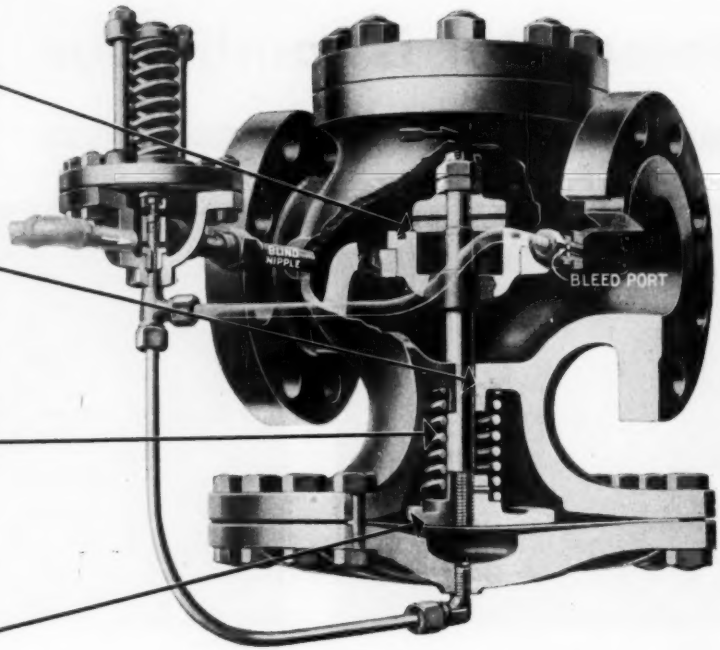
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

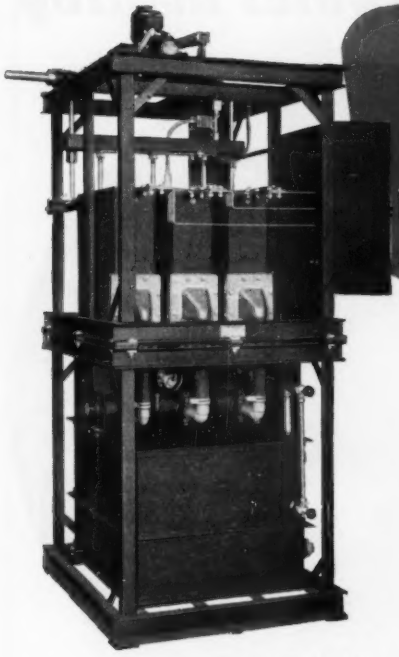
MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

BE-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

Stepless Speed Control of Boiler Draft Fans...



ALLIS-CHALMERS

Type 257 Liquid Rheostat

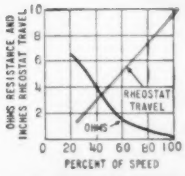
POWER PLANT CONTROL

DRAFT FANS operate at exactly the speed your boilers require for perfect combustion when Allis-Chalmers Type 257 Liquid Rheostats are used with a wound rotor drive motor. The right draft for any combustion condition is provided automatically by the wide range stepless speed control of these liquid rheostats.

They can be used with electrical, pneumatic or hydraulic pilot devices. Type 257 Liquid Rheostats have few moving parts, no arcing contacts, no mechanical connections to either fan or motor. This simplicity of design adds up to little or no maintenance.

You can keep the valuable floor space of your motor room free of bulky speed control devices by using Allis-Chalmers Type 257 Liquid Rheostats. Not only are they compact in size, they can be placed anywhere . . . even outside of the motor room. Call your Allis-Chalmers representative or write for leaflet 14S7544. A-3223

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.



Type 257 Liquid Rheostats are "application engineered" to give straight line speed characteristics.

ALLIS-CHALMERS

ORDER TELEGRAPH SYSTEMS

The Allis-Chalmers Order Telegraph System is accurate and reliable . . . can be depended upon even during station power failure because it uses the dc bus for its power source. An alarm system operates until the order is returned correctly. Select either five or ten inch semi-flush dials. Use it to transmit orders between switchboard and turbine room.

WOUND ROTOR PRIMARY MOTOR CONTROL

Make your Boiler Draft Fan Drive all Allis-Chalmers. Use the Type 257 Liquid Rheostat for secondary speed control, an Allis-Chalmers Type "H" Starter for primary control (bulletin 14B6410A), and an Allis-Chalmers wound rotor motor.

CONSIDER THESE

3 Factors

for best results in feedwater heating

Here's why you can be SURE of exactly the right feedwater heater for your particular plant conditions when you consult G-R.

1

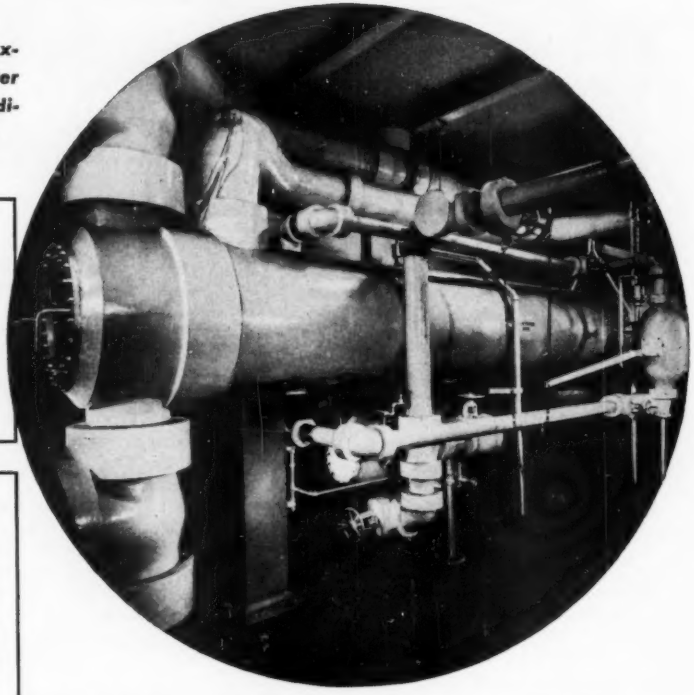
COMPLETE LINE . . . a type for every pressure and capacity . . . a selection of three designs of stationary heads . . . four designs of floating heads . . . straight-tube or U-tube bundles . . . any combination of condensing, sub-cooling, and desuperheating in a single shell.

2

EFFECTIVE DESIGN DETAILS . . . breech-block head for high pressure . . . pass partition sealing plates for prevention of leakage between passes . . . special baffles for steam guidance and prevention of tube erosion . . . special air and drain baffles for improving thermal efficiency.

3

60 YEARS OF EXPERIENCE in designing and building feedwater heaters . . . many hundreds of units in stationary and marine service.



This brief outline of G-R Feedwater Heaters is explained in detail in Bulletin 279, which graphically describes the many important features that are obtainable only in G-R designs. If you will write us your requirements, a copy of this informative bulletin, together with recommendations for your particular plant requirements, will be sent without obligation.

THE GRISCOM-RUSSELL CO., 285 MADISON AVE., NEW YORK 17, N.Y.

GR 232

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

TO DO A BETTER PIPING JOB...

USE

GLOBE

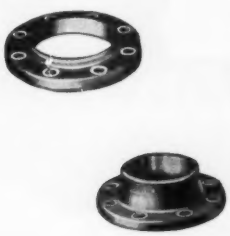
PRECISION PROCESS SEAMLESS WELDING FITTINGS

Your preference for Globe Welding Fittings is supported by a source of supply with exceptional qualifications. Specialized metallurgical experience and facilities gained in years of steel tubing manufacture enable Globe to produce welding fittings by a precision process that yields a superior product.

Send for the Globe Welding Fittings Catalog No. 501.

GLOBE STEEL TUBES CO., Milwaukee 15, Wisconsin

Chicago — Cleveland — Detroit — New York — Philadelphia — St. Louis — Tulsa — Houston — Denver — San Francisco — Glendale, Calif.

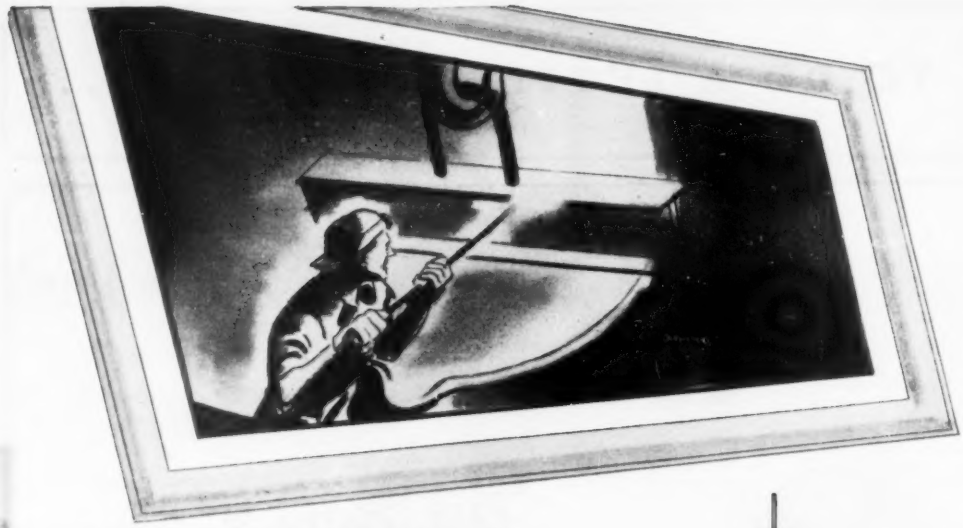


Producers of Globe Seamless Stainless Steel Tubes —Gloweld Welded Stainless Steel Tubes—Carbon — Alloy — Seamless Steel Tubes — Globeiron Seamless High Purity Ingot Iron Tubes and Pipe.

SIZE RANGE OF GLOBE SEAMLESS WELDING FITTINGS

Description of Fitting	Standard Weight (Schedule 40)	Extra Strong (Schedule 80)	(Schedule 160)	Double Extra Strong
Elbows 45° Long Radius	½ in. to 24 in.	¾ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Elbows 90° Long Radius	½ in. to 24 in.	¾ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Elbows 90° Short Radius	1 in. to 24 in.	1½ in. to 24 in.	- - -	- - -
Returns 180° Long Radius	½ in. to 24 in.	1 in. to 24 in.	1 in. to 12 in.	3 in. to 8 in.
Returns 180° Short Radius	1 in. to 24 in.	1½ in. to 24 in.	- - -	- - -
Reducers (Concentric and Eccentric)	1 x ⅜ in. to 24 x 20 in.	1 x ⅜ in. to 24 x 20 in.	1 x ⅜ in. to 12 x 10 in.	1 x ⅜ in. to 12 x 10 in.
Tees Straight	¾ in. to 24 in.	¾ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Tees Reducing Outlet	¾ in. to 24 in.	¾ in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.
Stub Ends Lap Joint	1 in. to 24 in.	1 in. to 24 in.	- - -	- - -
Caps	1 in. to 24 in.	1 in. to 24 in.	1 in. to 12 in.	1 in. to 8 in.

Flanges available 1 inch to 24 inches in all weights



LUNKENHEIMER

. . . The Steel Valve With A Priceless Ingredient

Into every heat of Lunkenheimer molten steel goes one ingredient that no other valve foundry can duplicate. It's not measured in ounces or pounds — but in generations . . . of tradition. It is pride in the kind of workmanship that has made Lunkenheimer universally respected as the one *great* name in valves.

Engineers are accustomed to dealing in facts — not intangibles. But every realistic engineer knows that molten steel is tricky stuff to handle. It demands *more* from the workman than simple attention. Quality valves—safe valves—are not made by formula alone, but by care . . . interest . . . pride in an unbroken tradition of fine workmanship. At Lunkenheimer, that tradition goes back to 1862.

Lunkenheimer's priceless ingredient will always be intangible, but it can be expressed in terms of one interesting fact: *there is no instance on record where a Lunkenheimer steel valve has ruptured due to defective metal.* For more facts — and for information relating to your specific steel valve application — write immediately to The Lunkenheimer Co., P. O. Box No. 360A, Annex Delivery Station, Cincinnati 14, Ohio.

STEEL • IRON • BRONZE

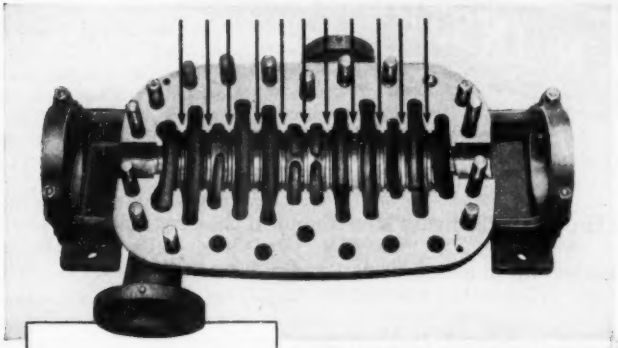
LUNKENHEIMER

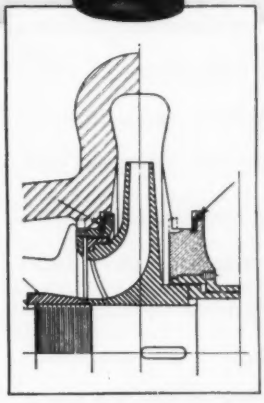
THE ONE *Great* NAME IN VALVES

L-750-13A

IN YOUR BOILER FEED PUMPING...

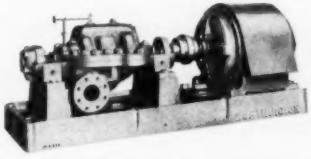
Get **HIGH** *reliability at* **MEDIUM** *pressure with* **LOW** *maintenance cost*





Lower casing half of a Worthington 6-Stage Type UR Centrifugal Volute Pump. Arrows point to joints protected by Worthington Elastic Seal Rings.

Worthington Elastic Seal Ring construction (solid black areas) in a Type UX Pump. Flexible and resilient, the Elastic Seal Ring assures initial seating, makes joints liquid-tight, eliminates a common cause of pressure loss.



This Worthington Type UQ Pump incorporates the Worthington Elastic Seal Ring, latest improvement in mechanical design.

WORTHINGTON

WORTHINGTON PUMPS, TYPES UQ AND UR, ARE TOP PERFORMERS AT PRESSURES UP TO 950 PSI

In power plants throughout the world Worthington Centrifugal Pumps, Types UQ and UR, have proved themselves the most modern small-capacity boiler feed pumps in the medium pressure range. Correct in every mechanical and hydraulic detail, they feature:

- **Balanced design . . .**
- **No stuffing box trouble . . .**
- **Freedom from interstage leakage . . .**
- **Low Maintenance Cost**

Built for long, trouble-free service, these multi-stage volute-type pumps are by far the most dependable and economical for your boiler feed jobs at pressures up to 950 psi.

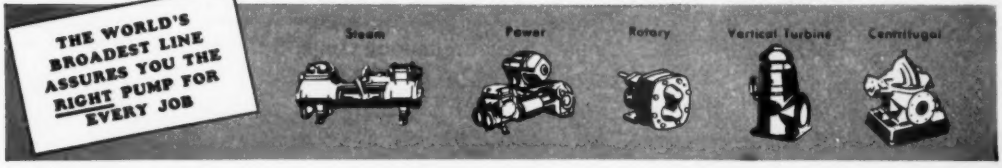
There's A Worthington Pump For *Every* Pressure Range

from 100 psi to 2400 psi and all outstanding in their class. In this most complete line you're sure to find exactly the right pumps for your own boiler feed requirements, large or small. For further proof that *there's more worth in Worthington*, contact our nearest District Office or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

MEMBER

co.2

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



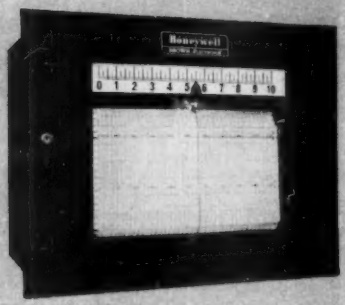
. . . Symbol of Simplified

THOUSANDS of users of Brown instruments have found in the products that bear this nameplate a leadership in sound design and construction.

Such qualities have not just happened. Rather, they are the result of constant development and improvement in terms of your ultimate use . . . reflecting practicability as well as suitability for a variety of instrumentation requirements. They are the result of thorough research, common-sense design engineering and practical field testing. Whether you are the owner of the plant, its superintendent, an operating engineer, or an instrument man . . . you will find in Brown instruments the contributions to simplified operation and maintenance, without sacrifice of accuracy, that are most important to you!

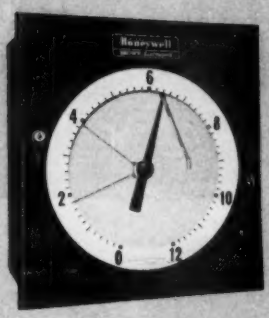
Call in your local Honeywell engineer . . . he is as near as your phone. MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

Operation and Maintenance



ElectroniK POTENTIOMETERS

All *ElectroniK* Potentiometers have common operating features which include: (1) the *Continuous Balance* principle that provides instantaneous and continuous responses to emf changes at the detecting element; (2) immunity to effects of vibration; (3) a minimum of moving mechanical parts greatly reducing wear and maintenance requirements; and (4) high operating speeds. These instruments may be used in connection with thermocouples, pH electrodes, Pirani gauges, tachometers, ultraviolet and infrared spectrometers, and other sensing or detecting elements wherein an emf is created. They are available with or without control in strip chart, circular chart, and circular scale types.



The instrument cases are interchangeable for flush and surface mounting. Swing-out chassis, which contain all moving parts, and accessibility of components make for simplified maintenance and operation.

THERMOMETERS, PRESSURE GAUGES, FLOW METERS and LIQUID LEVEL GAUGES

Brown rectangular case instruments are available for recording indicating and/or controlling *Temperature, Pressure, Flow* and *Liquid Level*. All utilize the same case and panel opening and are available for either flush or surface mounting. The ease of range changes, accessibility of and interchange between control units and other components add much to the simplification of operation and maintenance of these instruments.

PYR-O-VANE and *PROTECT-O-VANE* MILLIVOLTMETER CONTROLLERS

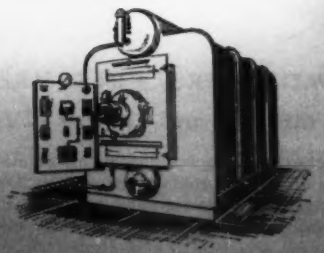
The *Pyr-O-Vane* Controller for one, two and three position electric control and the *Protect-O-Vane* excess temperature safety cut-off controller embody many similar features. A universal case interchangeable for flush or wall mounting, independent plug-in measuring unit and control unit, signal lights and ease of control point adjustment are all plus factors toward simplicity of operation and maintenance.

Write for Catalogs

ERIE CITY INTRODUCES

ERIE CITY KEYSTONE STEAM GENERATOR

- A 2-drum water tube boiler + automatic oil and gas burner + induced draft fan + operating and safety controls.
- Gas travels 3 lengths of the boiler—high efficiency with either oil or gas.
- Conservatively rated. Easily cleaned—nationally serviced.
- In 10 standard sizes: 75 thru 800 developed horsepower. Steam working pressure from 160 PSI.



For complete specifications - Write for Bulletin SB-38.

ERIE CITY IRON WORKS *1401 East Ave.* **ERIE, PA.**

ALLIS-CHALMERS
Hot Process—Hot Zeolite SYSTEM

..Offers ALL SIX!

1. Zero hardness
2. Low alkalinity
3. Low silica
4. Low total solids
5. Optimum pH
6. Low CO_2 in steam

PLUS: Simplicity of operation and low chemical costs!

LAWRENCE A. PEDERSEN, with over 17 years experience in power plant water conditioning, is one of the specialists located at key points throughout the country to advise you on correct equipment, chemicals and service. For free survey call your nearby Allis-Chalmers office.

CONVENTIONAL TREATING METHODS seldom produce a completely satisfactory boiler feedwater. Each method leaves power equipment unprotected in some way. Treating equipment selection normally is made on the basis of the *least* harmful effluent.

That is where Allis-Chalmers comes in. We know power equipment because we manufacture it, and we know how vital good water is to its performance. Now we insure that performance by offering the hot process — hot zeolite system, which gives complete control over *all six* critical water conditions.

Only a hot process — hot zeolite system obtains *low hardness* while reducing *alkalinity, silica, solids* and CO_2 *in the steam.* At the same time it raises *feedwater* pH to optimum values. There is no compromise of essentials with this combined treatment. Yet *chemical costs are low,* for only salt and lime are required for operation.

Guard against scale, embrittlement, foaming, carryover, corrosion and excessive blowdown with one system! Investigate the possibilities of hot process — hot zeolite treatment. Write for the free Allis-Chalmers bulletin 28x7559.

ALLIS-CHALMERS
Water Conditioning
✓ EQUIPMENT ✓ CHEMICALS ✓ SERVICE

ALLIS-CHALMERS, 952A SO. 70 ST. MILWAUKEE, WIS.

Gentlemen:

Please send me bulletin 28X7559.

Name .....

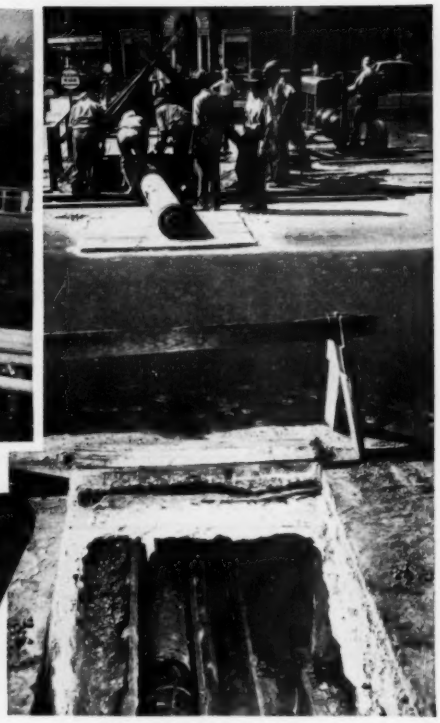
Title .....

Company .....

Address .....

City ..... State A-3219

Shaker Square, Cleveland, Ohio, showing Ric-wiL Piping ready for installation under Rapid Transit tracks.



Tunneling method used to install Ric-wiL pipe without traffic interruption.

RIC-WIL INSULATED PIPING INSTALLED WITH NO TRAFFIC INTERRUPTION

One of the important requirements in the job of installing insulated piping supplying steam for heating buildings of the congested Shaker Square area was to make the installation without interruption of either rail or street traffic on the exceptionally busy thoroughfares.

By cooperative engineering and planning, Ric-wiL Prefabricated HEL-COR Insulated Piping was installed by trenching on unused portions of the area and tunneling under the rail tracks and roadways, thus permitting an uninterrupted flow of traffic.

By eliminating field fabrication of insulation and outer protection, the Ric-wiL prefabricated 21-ft. straight sections and accessories were installed quickly and economically. In the tunnel installations the units were positioned by sliding them over the lower half of existing tile as shown in the illustration above.

This fast and low cost installation demonstrates one of the many advantages found in Ric-wiL Prefabricated Insulated Piping.

RIC-WIL 40th YEAR DEPENDABLE INSULATED PIPING SYSTEMS 1910 · 1950

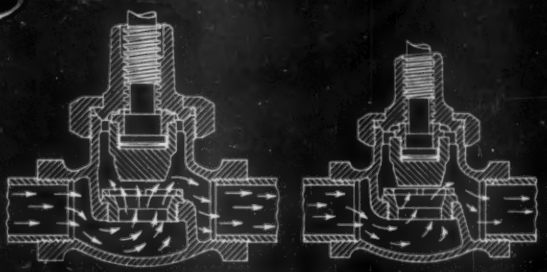
RIC·WIL INSULATED PIPING SYSTEMS

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 5-SA in Cleveland, Ohio.

OVERHEAD — THE RIC-WIL COMPANY · CLEVELAND, O. — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

POWELL gives you *Full Flow* in a Throttling Valve



COMPARE
the flow characteristics of the new Powell "W.S." Valve (left) and the ordinary globe valve (right). Note the extra large opening through the seat (nominal pipe size) and the greatly increased lift of disc, when wide open.

This is actually a dual service valve in that it can be throttled to any desired degree, yet, when wide open, permits FULL FLOW through the body. Thus turbulence and pressure drop are reduced to a minimum—a triumph in engineering that exemplifies Powell's continual leadership in the field of industrial valve design

Powell "W S."
Bronze Globe Valve
Fig. 2608

Write for folder giving full description of the many advanced engineering features of this valve.

POWELL

The WM. POWELL CO., 2525 Spring Grove Ave., P. O. Box 106, Station B, Cincinnati 22, Ohio

WOULD YOU PLAY A TOURNAMENT *with one club?*

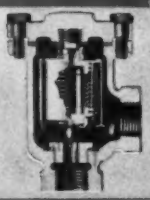
But on the golf course you can see the results. In steam hook-ups on the other hand, bad performance may go undetected for years, even though the traps apparently are working properly.

If you are in competition, it is certain that you cannot get the lowest fuel costs and highest production rates from steam heating and process equipment by "standardizing" on one type of steam trap for all purposes in your plant.

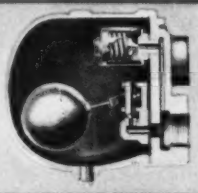
The four principal types of Sarco steam traps are illustrated at the right. They are available in a wide range of sizes and steam pressures and each has a specific function. The trick is to get the right trap on every steam job and every steam line in your plant. This can be done by calling in the Sarco Representative near you, or by asking for Sarco Catalog No. 1600 which gives recommendations for trapping all kinds of equipment, both indoors and out.

STEAM TRAPS ARE LIKE THAT...

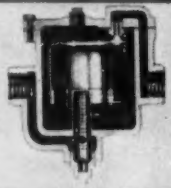
Thermostatic Trap



Float-Thermostatic Trap



Bucket Trap



Liquid Expansion Trap

312

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

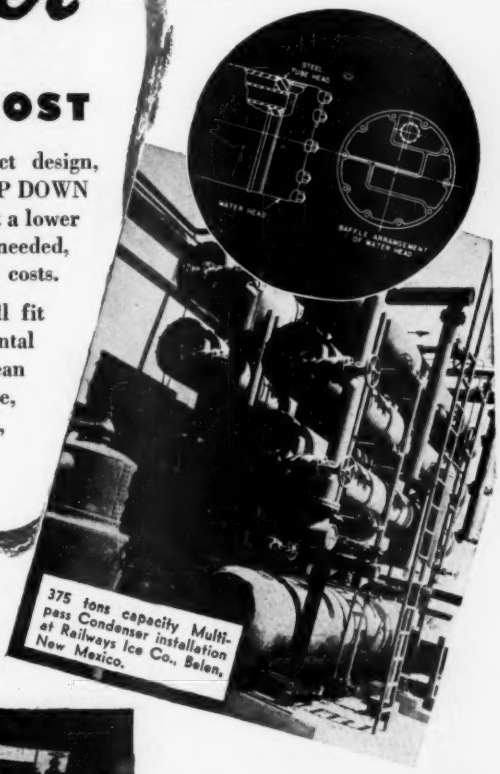
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

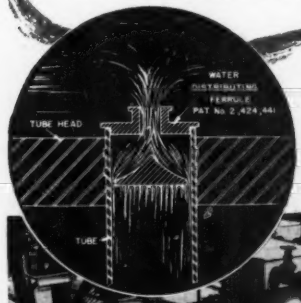
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

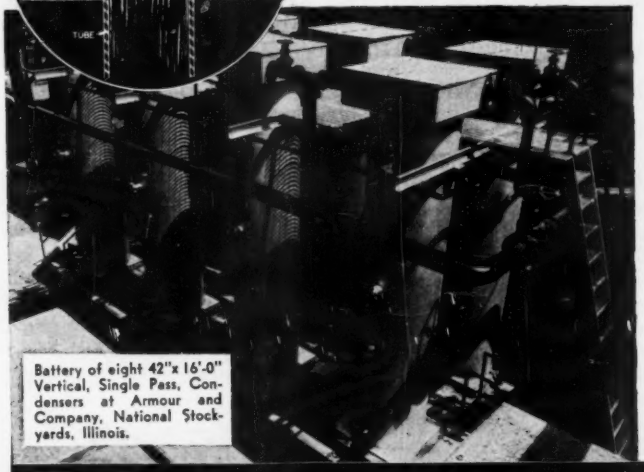


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



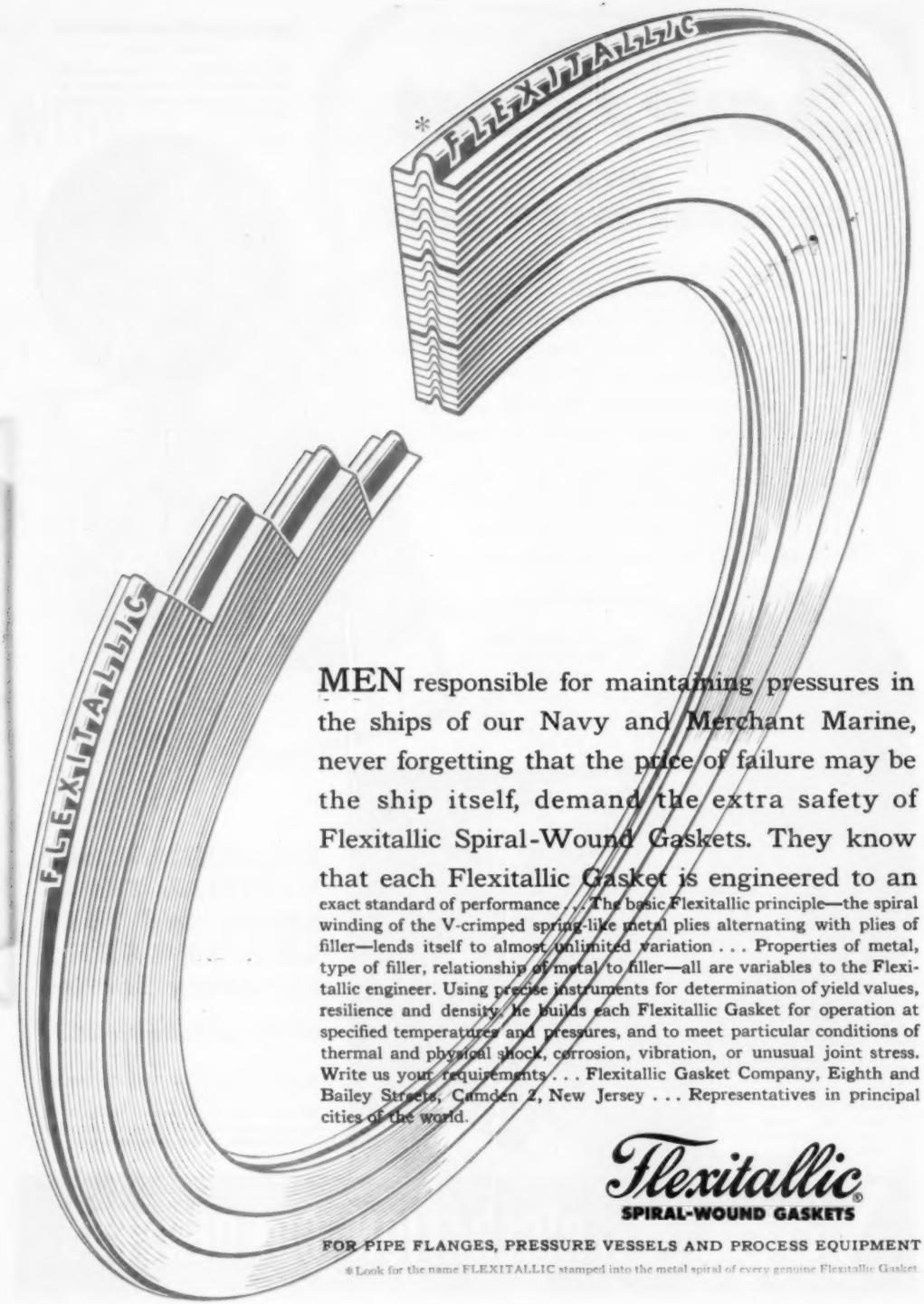
Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS



MEN responsible for maintaining pressures in the ships of our Navy and Merchant Marine, never forgetting that the price of failure may be the ship itself, demand the extra safety of Flexitallic Spiral-Wound Gaskets. They know that each Flexitallic Gasket is engineered to an exact standard of performance . . . The basic Flexitallic principle—the spiral winding of the V-crimped spring-like metal plies alternating with plies of filler—lends itself to almost unlimited variation . . . Properties of metal, type of filler, relationship of metal to filler—all are variables to the Flexitallic engineer. Using precise instruments for determination of yield values, resilience and density, he builds each Flexitallic Gasket for operation at specified temperatures and pressures, and to meet particular conditions of thermal and physical shock, corrosion, vibration, or unusual joint stress. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey . . . Representatives in principal cities of the world.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket

Power

PHILIP SWAIN, EDITOR • JANUARY 1951 • ESTABLISHED 1882

New Dress for POWER

As THIS IS WRITTEN, the U.S. is in the midst of a great crisis. Its outcome will have unknown effects on the lives of all of us. Against this background, it may seem out of place to talk here of such relatively minor matters as some changes we have made in this issue of POWER.

Yet it is the human capacity for going ahead with the job at hand that time and again brings us through periods of stress. In fact, such times put on us an obligation not only to carry on but to do so to the best of our individual abilities.

Our Job and You. We can't help feeling that POWER will have an increasingly important contribution to make in the months of struggle ahead. This gives special urgency to our continuing program to better POWER, and to maintain its leadership by making it ever more useful and interesting to you, its readers.

The biggest part of this job, of course, is bringing you the kind of material you need, in the way you want it. We check how well we're doing on that score each month, by asking a selected group of readers to tell us. And we guide ourselves by these continuing reports from you.

Engineer readers put prime importance on the "goods" we deliver in our pages, yet all of us like to see a product well packaged. While working as always to keep improving the product itself, we've recently been making a critical re-examination of each element in POWER'S format—the package. This month you see some first results of this program for making POWER even easier to use, and easier to look at, too!

Cover Format. We started at the beginning—with the cover and the *logotype*. That's what printers call the distinctive way the name POWER appears on the cover and in other display elements of the magazine. It's our "trademark," in a manner of speaking, and hence not to be changed lightly.

In redesigning it, we sought the modern feeling that must pervade any magazine leading a fast-moving field. Yet we also sought to express the stability characteristic of both the field and the magazine. And, of course, we wanted the feeling of *power*. We believe our consulting designer has caught these aims in distinctive lettering. What do you think?

The new logotype will be used each month in a cover format varied to achieve the most attractive over-all result. When color photographs of outstanding quality are available, we will run four-color covers. But we still don't believe in color for color's sake.

Contents Page. Next we tackled the contents page. That, you've probably discovered by now, has moved up front and grown to two pages (pp 3, 5). The new location makes it easier to find; the greater space gives us a chance to make it more interesting and useful. In addition to the table of contents, masthead and indicia —the vital statistics, as it were—we can now give you: (1) a preview of next month and future issues (2) background dope on articles and authors, and (3) letters from readers and news about reader activities.

Thus, this and future forewords appear on what was, for many years, the contents page. And we move into our lead article on the first page of the main editorial section, where once our forewords bloomed. You'll get used to it soon, we're sure, and we hope you'll like it. Let us know, and don't pull any punches.

A Seasonable Greeting. As we enter a new year fraught with more dangers than any since Pearl Harbor, it seems unrealistic to wish you a "Happy New Year." Instead, our wish is that each of us may stand steadfast, strong with faith in our country and its mission.

Exciting News!

Reliance *removable packing box* water gage valve—latest development for safer, better gage maintenance

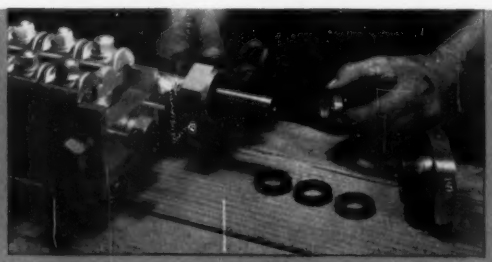
● This new-type valve reduces time spent near the drum—lets you take inserts and nipple packing boxes down for *bench convenience* servicing.

A better packing job prevents steam-cutting of nipples on expensive high pressure inserts. Assure longer insert life by always using completely *new* packing and gaskets. With these valves they can be properly installed where work can be done in comfort.

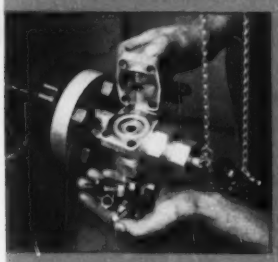
A heavy-duty valve of forged steel in typical Reliance rugged construction, available in flanged or screw connection. Good for pressures up to 900 psi. Profitable to use for power boiler service or oil, ammonia, Dowtherm, acids. Highly praised by engineers who have installed them. Write for catalog page B2.3

THE RELIANCE GAUGE COLUMN COMPANY • 5902 CARNEGIE AVE., CLEVELAND 3, OHIO

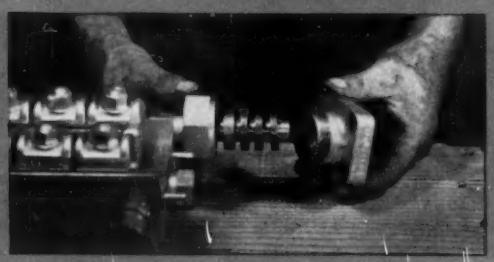
A Remove four bolts from each valve.



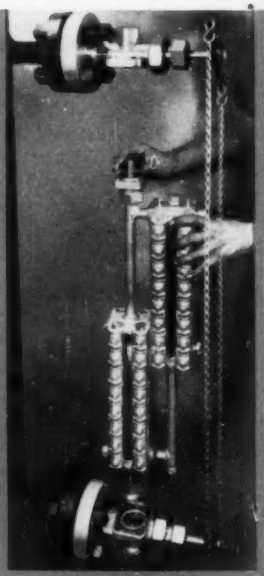
C Place packing nuts over gage insert nipples—follow with metal packing glands and 3 packing rings per nipple.



B Remove flanged packing boxes.

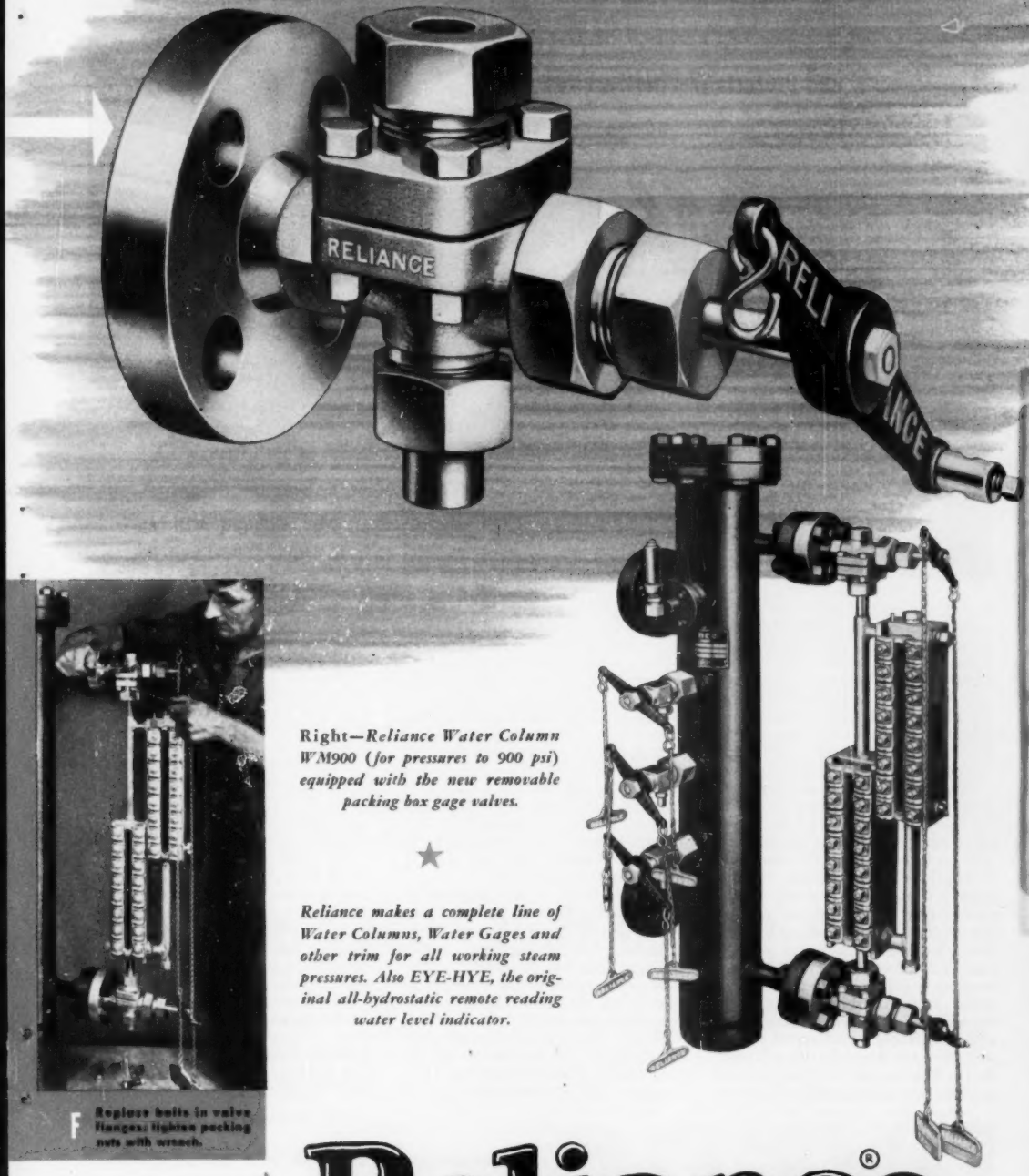


D Slide packing boxes over nipples and screw packing nuts into boxes.



E Place corrugated metal gaskets and slide insert into position.

The name that introduced safety water columns . .



F Replace bolts in valve flanges; tighten packing nuts with wrench.

Right—*Reliance Water Column WM900 (for pressures to 900 psi) equipped with the new removable packing box gage valves.*

★

Reliance makes a complete line of Water Columns, Water Gages and other trim for all working steam pressures. Also EYE-HYE, the original all-hydrostatic remote reading water level indicator.

...in 1884

Reliance®

BOILER SAFETY DEVICES

Another Steam Plant Picks

BYERS WROUGHT IRON PIPE

and Protects 17 Vital Services

In the million-dollar steam generating plant of the Jeffrey Manufacturing Company, Columbus, Ohio, pipe materials were carefully selected to meet service conditions . . . so, for 17 varied services facing corrosive hazards, the designers selected wrought iron pipe to forestall the maintenance threat of early failure and costly replacement.

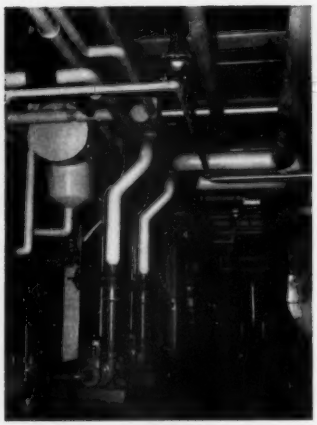
Over 19 tons of Byers Wrought Iron pipe, in sizes from ½ to 12 inches, was installed in these punishing services: boiler blow-off piping; water walls and columns to blow-off tank; atmospheric exhaust piping from safety valves; atmospheric vent piping (except plumbing vents); condensate piping; overflow, drain and chemical piping; raw and softened city water lines; cooling water supply and return lines; and all above-ground soil waste lines, plumbing drains, vents and downspouts. Portions of the installation are shown in the pictures. A. M. Kinney, Inc., consulting engineers, were responsible for these sound specifications. Lieb-Jackson Co. handled the fabricating.

Because conditions vary so widely, all of these services may not be problems in your plant. One, however, is always a headache—condensate returns. Condensate is invariably aggressive, and while treatments of various kinds may help, the only basic solution is the installation of corrosion-resistant material. Wrought iron has been so uniformly successful in this service that it should be considered whenever you are aiming for maximum durability.

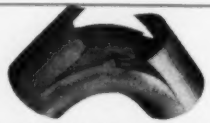
Power plants in all sections of the country depend on the time-tested durability of wrought iron. In a number of reported cases, wrought iron has doubled, tripled, even quadrupled the useful life previously obtained from low-first-cost piping material.

If you are contemplating new construction, or extension or replacement of existing piping services, you'll find it profitable to check up on the performance of wrought iron. Our bulletin WROUGHT IRON FOR PIPING SYSTEMS discusses some of the corrosive conditions found in various services and illustrates a few of the many places where engineers have successfully applied wrought iron . . . ask for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.



Wrought iron condensate and miscellaneous water lines in new steam plant.



WHY WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unusual fibrous structure of wrought iron—which is responsible for the unusual corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

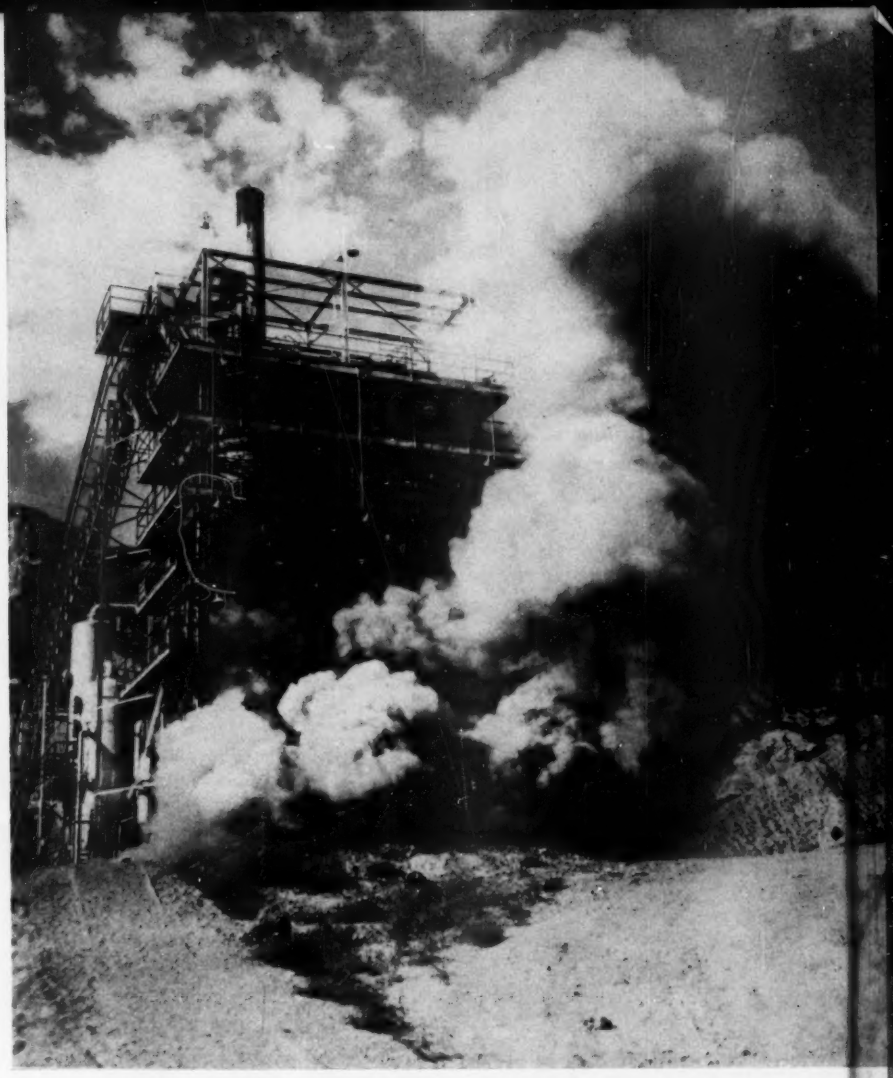
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



RETORT LETS GO

Spent-shale dumping from batch-type retort sends up billowing cloud of smoke and dust. Here combustible element of oil shale distills from rock in which it is imbedded. Condensed crude oil can be refined by usual means

Oil From Shale—Is It Coming Soon?

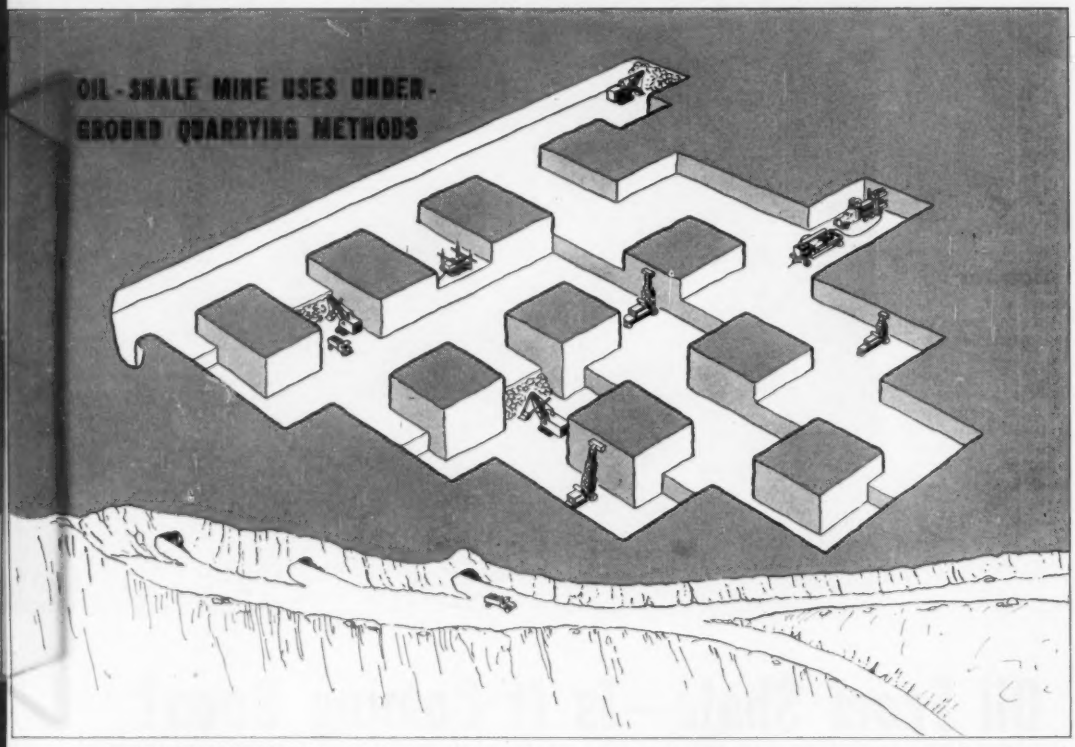
Bureau of Mines originates new mining, processing methods to overcome limitations of oil shale. Associate Editor Ben Skrotzki brings you impressions of visit to Colorado's demonstration project

► MANY OF US HAVE vivid memories of gasoline and heating-oil shortages during World War II. They were caused by abnormal war demands and lack of transportation capacity. The condition highlighted the fact that at any one time we have only about a 10-year oil supply in sight. This has been true, however, for more than the past 20 years. Thus, we have been fortunate in making new discoveries keep pace with increasing demands.

Lately, though, reports have come in showing we are drilling a greater proportion of dry holes. It seems some day we will drain our last drop of oil out of the ground. To meet that day we must have other sources ready. Conversion of coal to oil has long been under study. This activity has been highly favored because we have over a 2000-year supply of high-volatile bituminous in reserve and much more sub-bituminous and lignite.

Turn page for story

UPPER LEVEL OF MINE shows horizontal layers of oil shale in 60-ft square pillars. Note smooth formation of roof, floor



OIL-SHALE MINE LAYOUT follows richest bed, Mahogany Ledge, to remove total depth of 73 ft in three levels. Shale, producing about 30 gal oil per ton, will be moved out by truck through three adits and over road to nearby processing plants

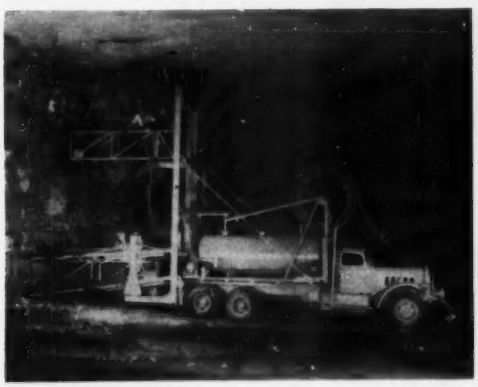
To date, laboratory and pilot-plant work, carried on by Bureau of Mines and others, have shown synthetic oil from coal to be costly, too high to be competitive with present-day products of petroleum. But there is more than one way of skinning a cat. Oil can be made from other materials. Oil-shale deposits are scattered through 20 states and Alaska. The most promising is the Green River formation of Colorado, Utah and Wyoming. The richest portion is a 1000-sq-mile area in western Colorado.

This 500-ft-thick bed assays about 15 gal oil per ton making a total of 300 billion barrels of oil. Compared to our present annual consumption of oil, the deposit has a 150-year supply of oil. Putting it another way, this equals seven times the amount of oil we have used in the U.S. since its discovery in 1859. The lower segment of the Green River formation, from 70 to 94 ft deep, called Mahogany Ledge, assays 30 gal per ton and should give a net yield of 100 billion barrels. This stratum has best possibilities for commercial development.

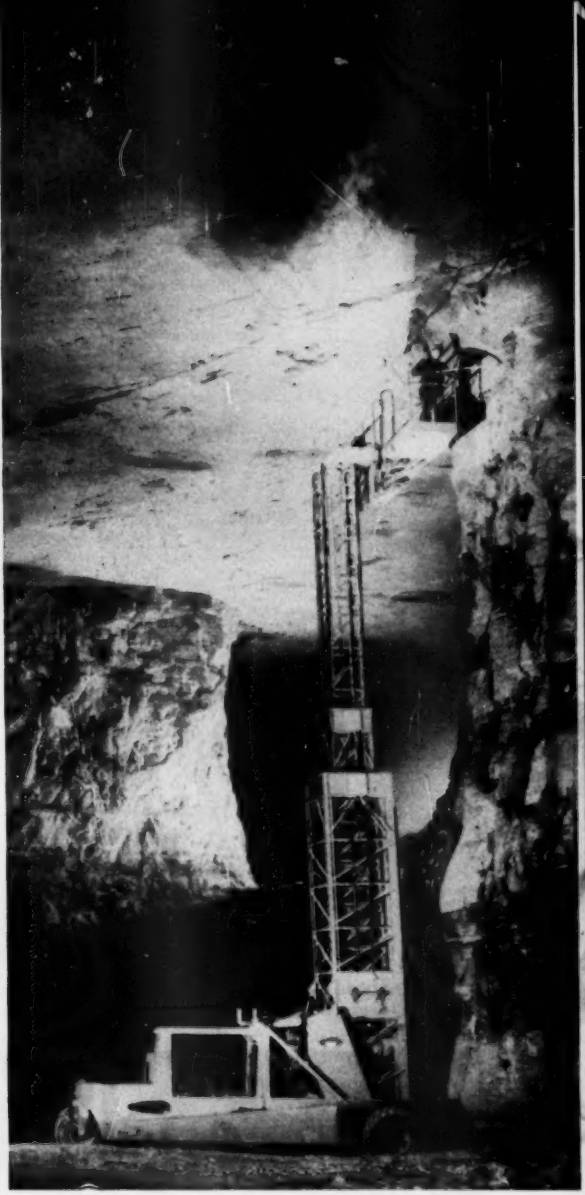
Why hasn't this vast reserve been

BLASTED OIL SHALE is loaded into 15- and 22-ton trucks by 3-cu-yd electric shovel. Using large equipment reduces costs

PORTABLE COMPRESSOR STATION, electrically driven, supplies air to drills. Here is jumbo used for driving vertical holes



FOUR BLASTING HOLES are driven simultaneously by percussion drills mounted on this jumbo. Drills 72 holes in 6 hr

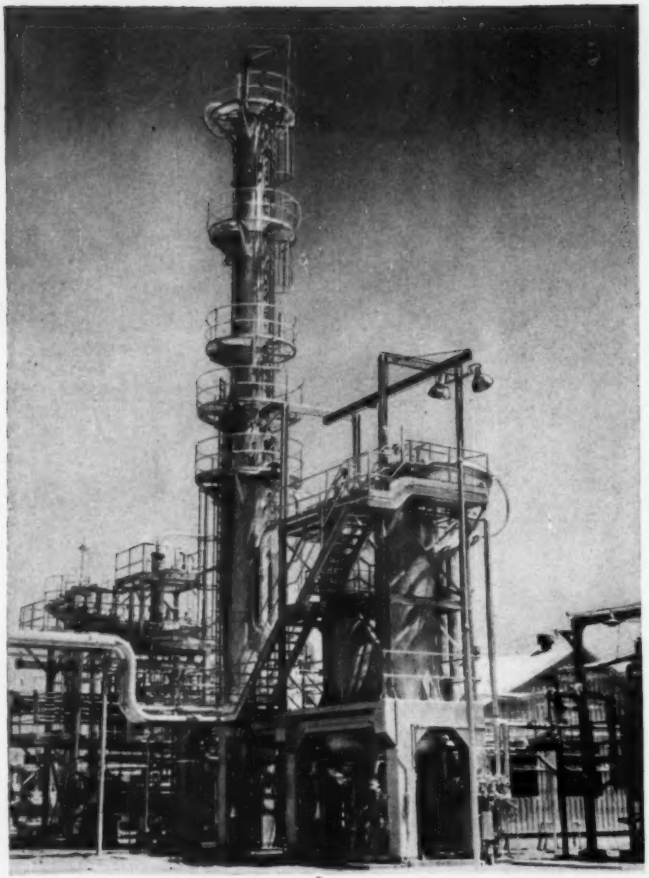


TELESCOPIC SCALING RIG gives a safe method of removing loose rock from roof and pillar walls. Note two levels here

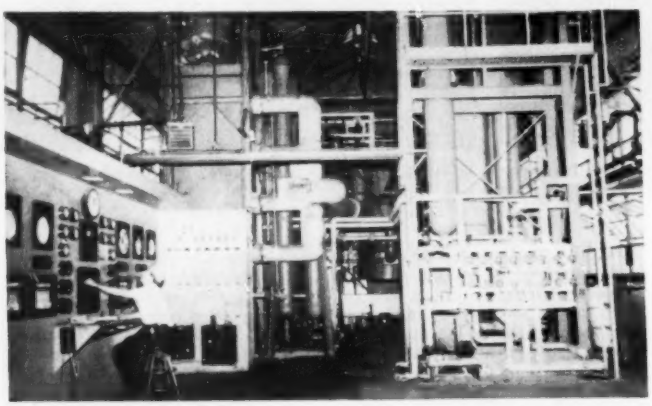
tapped in an oil-hungry world? Because other fuels have been much cheaper to extract from the ground. What makes oil shale a cost problem? Oil shale is not oil shale! It is a combustible organic substance, kerogen, mixed in a rock called marlstone. The hitch comes from a given weight of oil shale containing only about 10% of kerogen; the other 90% is useless rock, gases and residue. Heating the shale vaporizes the kerogen, which on condensing forms a crude oil. The crude can be processed to yield about the same products obtained from petroleum. We have to handle a tremendous amount of inert material to get at the heat-producing element.

To attack this problem the Bureau of Mines, U.S. Dept of the Interior, has set up a demonstration mine and processing plant at Rifle, Colo. Successful mining operations avoid handling unwanted materials. In coal mining, for example, excavations follow the seam and do not touch surrounding rock if possible. We can't avoid handling large amounts of rock in mining oil shale, but the immense depths of the beds offer a solution.

Turn page for story



DEMONSTRATION PLANT includes small oil-refining and cracking plant to make standard products from crude shale oil. Fractions include gasoline, diesel oil, etc



CONTINUOUS-TYPE RETORT passes hot gas stream up through broken shale moving downward in steady flow. Hot gas vaporizes kerogen in shale, condenses out as oil

The mining problem boils down to developing low-cost handling methods. This is done in the demonstration mine by using large 3-cu-yd electric shovels, 22-ton dump trucks, high-speed drilling rigs, telescopic portable scaffolds, etc. The mine really is an immense underground quarry worked at three levels as shown in the drawing, p 72.

By mechanizing all aspects of the mining or quarrying operations the output per manhour has been remarkably increased and the unit costs brought down. In strip mining of coal about 16 tons per man-day are produced, in underground operations about 5.5 tons per man-day. The last test run at Rifle showed an average output of 116 tons of oil shale per man-day.

Further Work. This is only the beginning of the project, however. The Bureau feels that costs can be brought down and production upped by further study. It can be done by (1) developing successful rotary drills to replace present percussion drills (2) improving blasting techniques (3) getting more data on maximum safe width between mine pillars (4) designing more efficient underground loading equipment.

Processing oil shale involves crushing, retorting and refining. Crushing problems arise from the different breaking characteristics of various grades of oil shale. Rich shales break along laminations, being tough and rubbery. Sparser shales have desirable behavior in breaking across laminations. Improvements in this operation should be possible.

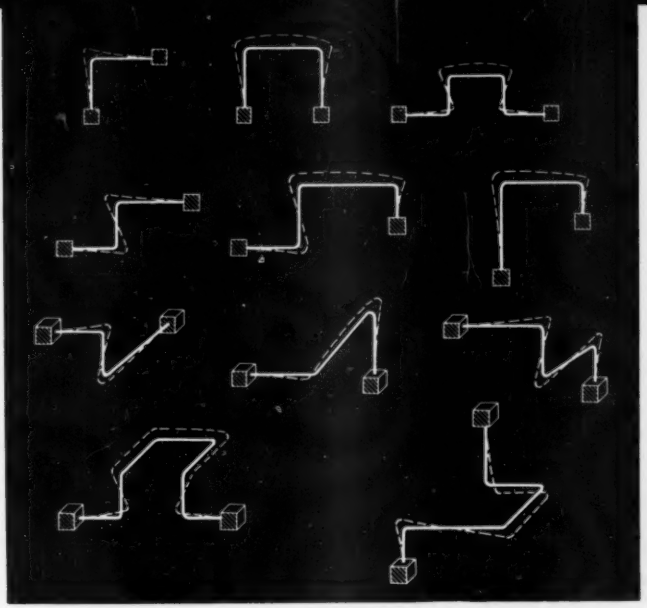
There are thousands of patents on retorts that could be used for vaporizing the kerogen into oil vapors. Two methods are under investigation at Rifle. Other researches are being carried out by the Bureau at other locations, and several by private oil companies interested in the oil-shale program. One method at Rifle is a batch process using two NTU retorts shown on p 71. A retort is loaded with crushed shale and set afire at the top. The fire burns its way downward through the shale under stimulus of a forced downdraft. The hot combustion gas distills the kerogen which is liquefied in a condenser.

Other method is a continuous-flow process in which a continuous flow of crushed shale passes down through a retort. A continuous flow of hot gas passing upward through the shale carries off the distilled kerogen for condensation.

Indicated costs from this demonstration plant are within shouting distance of commercial possibility. We should see oil from U. S. shale within our lifetime.

Choose pipe hangers for your next job by using the tips Frank Kamarck, ME, New York, gives. They're fast, easy:

1 **Make isometric sketch**
2 **Spot hangers on sketch**
3 **Study building steel**
4 **Calculate hanger loads**
5 **Draw shape of hot pipe**
6 **Figure flange movement**
7 **Compute pipe movement**
8 **Find movement at hangers**
9 **Pick the hanger**
10 **Choose rod diameter**



1 **PIPE SHAPES** commonly used in power and similar plants assume approximate forms shown by dotted lines when temperature rises. Sketches aid selection

10 Easy Steps for Selecting Pipe Hangers

► THE TWO MAIN FACTORS governing selection of pipe hangers are: (1) change in length that causes movement of pipe (2) weight to be supported. First factor results from increased temperature during operation. Second depends on pipe used, flowing medium, insulation chosen, and number and type of fittings in line supported.

Fig. 1 shows general effects of increased temperature on a number of typical pipe shapes. It's of utmost importance when choosing hangers to be able to approximate amount of displacement and its direction when pipe is hot. Most plant piping can be hung or supported correctly by using common sense and a minimum of theory and calculation.

Basic Data. To properly hang or support pipe, certain basic data must be on hand. Facts assembled here are those experience shows helpful in practical hanger and support problems. Let's look these data over before seeing how they are used.

Pipes expand with temperature increase. Movement accompanying this expansion is one of the two important factors that must be taken into consideration when picking hangers or supports. Table IV gives expansion in inches per foot for two useful installation temperatures and various operating temperatures. For example, with a 32-F installation temperature and 500-F operating temperature, expansion of pipe is 0.04 in. per ft. If there's a run of 50 ft of straight pipe under these conditions, total expansion when at operating temperature is $50(0.04) = 2$ in.

Hanger spacing must be close enough to prevent excessive sagging that overstresses pipe or interferes with drainage. Table II lists maximum recommended spacing between supports for various sizes of pipe.

When a pipe acts as a cantilever beam with a load at free end, there's a deflection that accompanies the stress in pipe. Use Table I to quickly find deflection necessary to produce bending stress of 14,000 psi in a length of pipe.

Load a hanger rod can safely carry depends on rod diameter and operating temperature. Table III gives safe loads for rods of various sizes at common operating temperatures. These loads should not be exceeded because failure of a rod will cause overloading or breakage of near-by hangers and may damage the line itself.

Selecting Hangers. Now that we know what data are used when picking a hanger or support we can set up a simple procedure for using them. My experience shows this procedure is good for all usual piping systems. For fast, accurate hanging of pipes follow these ten steps:

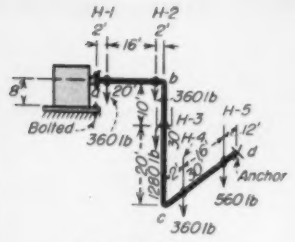
1. Draw a freehand isometric sketch of your piping system. Sketch similar to Fig. 1 is good. It's not necessary to draw it to exact scale; if proportions are correct, results will be good.

2. Spot in hangers tentatively. First, put in end hangers as near unit as possible. Keeping hangers close prevents overloading connection on unit. Next, refer to Table II and space intermediate hangers so recommended spacing is not exceeded for pipe being hung.

3. Examine building structural steel in vicinity of hanger locations and adjust them on sketch so problem of supporting hangers or supports is made as simple as possible.

4. After adjusting hanger or support locations, calculate loads to be carried. Fig. 2 shows how to find loads. Mark all loads on sketch.

5. Using Fig. 1 as a guide draw a dotted outline of approximate shape pipe will take when hot. Try to establish corner points first because they're important. Easiest way is to start with first corner point near the unit served



Steps 1, 2, 3 & 4

Calculations for step 4: Hanger loads

6-in. Schd 80 pipe = 28.6 lb/ft

Insulation used = 11.4 lb/ft

40.0 lb/ft

Load on hanger H-1 = 40(1'+8') = 360 lb

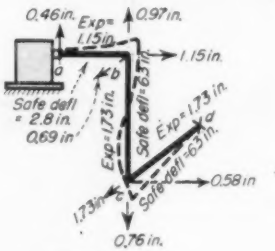
Load on hanger H-2 = 40 (8'+1') = 360 lb

Load on hanger H-3 = 40 (1'+30'+1') = 1280 lb

Load on hanger H-4 = 40 (1'+8') = 360 lb

Load on hanger H-5 = 40(8'+6') = 560 lb

2 CALCULATIONS for first four steps are made as shown in this problem



Steps 5, 6 & 7.

Expansion : 60 to 700 F = 0.0575 in/ft

Upward expansion at "a" = 8 x 0.0575 = 0.46 in.

Expansion of a-b = 20 x 0.0575 = 1.15 in.

" " b-c = 30 x 0.0575 = 1.73 in.

" " c-d = 30 x 0.0575 = 1.73 in.

3 EXPANSION of various parts of pipe is figured by using data of Table IV

I: DEFLECTIONS THAT PRODUCE 14,000-PSI TENSILE STRESS IN PIPE LEGS ACTING AS CANTILEVER BEAM, LOAD AT FREE END

Cantilever length, ft	NOMINAL PIPE SIZE, IN.								
	1	2	3	4	6	8	10	12	14
5	0.88	.49	.33	.26	.17	.13	.11	.09	.08
10	3.53	1.94	1.33	1.03	.70	.54	.43	.36	.33
15	7.94	4.36	2.98	2.32	1.58	1.21	.97	.82	.74
20	14.10	7.76	5.30	4.12	2.80	2.15	1.72	1.45	1.32
25	22.00	12.1	8.28	6.44	4.38	3.35	2.69	2.27	2.07
30	31.75	17.45	11.93	9.26	6.30	4.83	3.87	3.27	2.98

II: MAXIMUM RECOMMENDED SPACING BETWEEN PIPE HANGERS

NOMINAL PIPE SIZE, IN.																
1	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
MAXIMUM SPAN, FT.																
7	9	10	11	12	13	14	16	17	19	22	23	25	27	28	30	32

III: HANGER-ROD LOAD CARRYING CAPACITY

Hot-rolled steel rod

Nominal dia of rod, in.	Thread root area, sq in.	Max safe load on rod, lb, at rod temp of: 450 F	750 F
⅜	0.068	610	510
½	.126	1130	940
⅝	.202	1810	1510
¾	.302	2710	2260
⅞	.419	3770	3150
1	.552	4960	4150
1⅛	.693	6230	5200
1¼	.889	8000	6660
1⅜	1.053	9470	7800
1½	1.293	11630	9700

IV: THERMAL EXPANSION OF PIPE

Carbon and carbon-moly steel and WI

Operating temperature, F	Inches per foot — Installation temp, F: 32	60
100	0.005	0.0029
150	.009	.0069
200	.013	.0108
250	.017	.0148
300	.022	.0197
350	.026	.0237
400	.030	.0277
450	.035	.0326
500	.040	.0376
550	.045	.0425
600	.050	.0475
650	.055	.0525
700	.060	.0575
750	.065	.0624
800	.070	.0674
850	.075	.0724
900	.081	.0784
950	.087	.0843
1000	.094	.0913

by the pipe. This point will move away from unit. Do same for first corner point near other unit served by pipe.

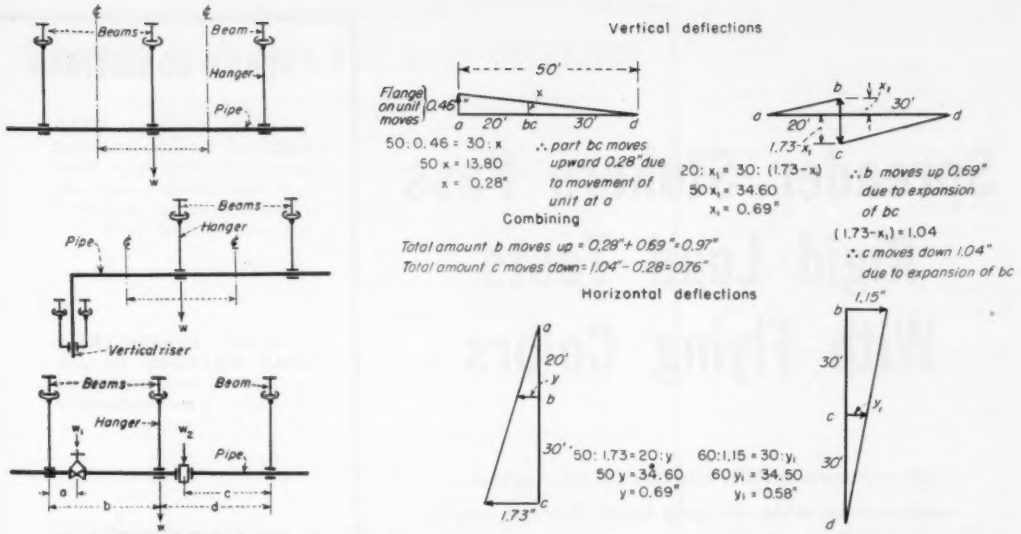
Remember, also, that a straight piece of pipe expanding against a piece at right angles will bend it. Distance pipe of various lengths will bend safely is given in Table I for various pipe sizes and pipe lengths.

6. If unit operates hot, establish amount of movement at unit flanges to which piping connects. Do this by taking vertical and horizontal distance of flange face from the point of no movement of unit. This is the point where unit is fastened to cold structural steel or concrete. Fig. 3 shows how vertical movement is figured and Table IV gives expansion per foot.

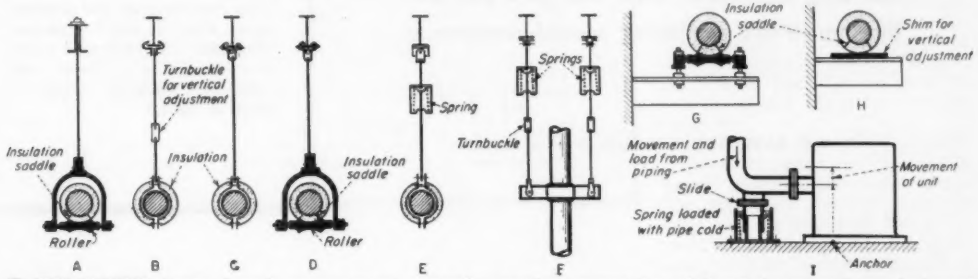
7. Now extent of pipe movement can be determined. Using Table IV find movements at first corner points away from the units, taking into account movement of unit flanges previously figured. Next, establish amount of elongation of each leg. Mark this information on your isometric sketch. From Table I find safe deflection for each leg and note on sketch.

With these data on sketch it's possible to estimate movement at all corner points for practical pipe-hanging purposes. Distribute total expansion in each direction by proportion to the length of the parts at right angles to the expansion, Fig. 4. Work from both sides of piping system until satisfied that movements check with expansions of separate legs and look reasonable. It's generally sufficient to do this carefully for vertical movement and estimate horizontal movements roughly.

Where a piping system is of the importance of a main steam line it is desirable to check or establish these movements with calculations such as some pipe manufacturers' charts give for the simpler shapes. In a later article, I will discuss an exact procedure for finding movement of more complex pipe shapes.


Beams
Beam
Hanger
Pipe
Vertical riser
Vertical deflections
Flange on unit moves
0.46"
50'
20'
30'
50: 0.46 = 30 : x
50 x = 13.80
x = 0.28"
∴ part bc moves upward 0.28" due to movement of unit at a
20: x1 = 30: (1.73 − x1)
50 x1 = 34.60
x1 = 0.69"
∴ b moves up 0.69" due to expansion of bc
(1.73 − x1) = 1.04
∴ c moves down 1.04" due to expansion of bc
Combining
Total amount b moves up = 0.28" + 0.69" = 0.97"
Total amount c moves down = 1.04" − 0.28" = 0.76"
Horizontal deflections
1.15"
1.73"
50: 1.73 = 20 : y
50 y = 34.60
y = 0.69"
60: 1.15 = 30 : y1
60 y1 = 34.50
y1 = 0.58"

4 **FIGURE HANGER LOADS** of uniformly loaded pipes as one-half weight to either side of hanger. Use beam relations for concentrated loads. Add uniform, concentrated loads to find total, *left*. Quick approximation, *right*, finds deflections of pipes



5 **PIPE HANGER** chosen depends on movement expected. Hangers at *A* and *B* are suitable for movement in one horizontal direction. Use hangers at *C* and *D* for movement in two horizontal directions. Vertical and horizontal movement requires use of hanger like that at *E*. A vertical riser that moves horizontally and vertically can be supported as at *F*. Where cantilever support is needed and pipe moves in one horizontal direction, use support *G*. For sliding movement in two horizontal directions, support *H* is good. Base elbow for protection of unit served by piping is shown at *I*. Movement is in vertical and horizontal directions. Spring is loaded with pipe cold by tightening threaded sleeve to the expected load with pipe hot

8. Having found movements at corner points, you can find those at any intermediate points simply by proportion, Fig. 4. Or find movement by laying out length of legs and movements at ends and scaling the movement at the hanger points for that pipe leg. Mark movement at each hanger on your isometric sketch.

9. Now we have gathered sufficient data to select the proper hangers. Type hanger selected is based on movement it must handle. Fig. 5 shows typical hangers together with movements they are designed to meet. With a tentative selection from this figure refer to a hanger manufacturer's catalog for other hangers, which have the same movement but which may fit in better with supporting structural steel conditions.

10. From Table III select hanger-rod diameter for each loading after having chosen hanger type. Remember that loads given must not be exceeded for safe design.

Springs are standardized and can be selected for the loading and vertical movement directly from a pipe-hanger catalog. Springs are listed on a basis of loading per inch of travel. For small movements it is generally desirable to select a lighter spring and precompress it at installation so it has a loading. Hanger movement will complete loading spring up to desired hanger load. This is desirable from another angle, also. Any error in estimating hanger movement will not throw quite so much unbalanced load on pipeline as would a heavier spring with a greater loading per inch of travel.

Fig. 2, 3 and 4 show how certain steps outlined here are applied to a typical pipe-hanging problem. Use them as a guide for solving problems in office or plant.

In piping systems having very little or no increase in temperature during operation, the 10-step procedure outlined will be simplified accordingly.

Spreader Stokers Pass Rigid Load Tests With Flying Colors

Here are some specific answers on how spreader stokers meet wide swinging loads. The test runs showed this user how to set up economical operating procedures—what was good and bad banking—where reinjection proved worthwhile

By R W GAUSMANN, *Indianapolis Power & Light Co*

PLANT CONDITIONS

1. LOW ANNUAL LOAD FACTOR. Pulverized-coal-fired boilers with their high initial costs, high auxiliary-power consumption could not be justified with such low load factors

2. RAPID, UNPREDICTABLE LOAD CHANGES. For such service, it was thought that chain or traveling grate stokers would operate at a handicap

3. SIZABLE STANDBY SERVICE. The underfeed stokers in our plants had shown rather high maintenance and banking costs when in standby service. Available data indicated a distinct possibility of lower costs with the spreader stokers in standby service

► INDIANAPOLIS POWER & LIGHT CO serves a rather large district steam-heating load in addition to supplying high-pressure process steam to a number of factories and industrial concerns. The process-steam sendout varies very little from season to season, but heating steam demands fluctuate widely with prevailing outdoor temperature. Total of both steam demands runs about 1,300,000 lb per hr. These demands divided nearly evenly between high-pressure process and low-pressure heating steam.

In January 1950, two spreader-stoker-fired boilers, 150,000 lb per hr, 260 psig, 500 F outlet steam with feedwater at 212 F, Fig. 3, were put in to help 26 underfeed-stoker-fired boilers supply the peaking portion of the steam demands as well as standby. Pulverized-coal-fired boilers already installed serve all base-load requirements of the system. Boiler water is 100% lime soda treated.

Boiler Equipment. Each new boiler has a drainable-type superheater to avoid any plugging of the bottom loops—an occurrence that has happened with pendant-type superheaters serving boilers supplied with 100% lime-soda treated water. (This plugging of pendant-type superheaters normally takes place during down periods. Flushing out the superheater before firing up can prevent this trouble.) Since we anticipated frequent down periods we thought a drainable-type superheater would be preferable. Further, we felt by isolating the superheater headers in a cool portion of the setting, Fig. 3, header warpage, often encountered in drainable-type superheaters, could be avoided. The boiler manufacturer thought such a design practicable only when a limited amount of superheat was desired.

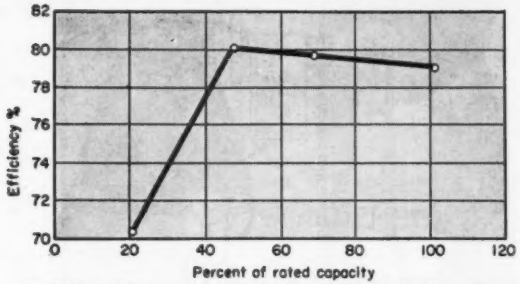
Air heaters were omitted since a study indicated they were not justified at the predicted low load factors. A possible high maintenance of air heaters under the expected prolonged banking periods further influenced our decision.

While we had soot-blower wall boxes put in, we decided to delay actual installation of soot-blowers until they were needed. We felt that the scrubbing action of flyash might prevent buildup of soot deposits.

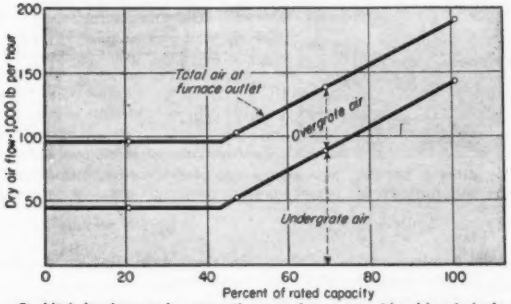
Air Pollution. In designing the boilers, air pollution came in for a great deal of attention since the plant is close to the center of Indianapolis. We insisted upon adequate overfire air to prevent smoking at higher loads. Smoking at very light loads we realized could not be avoided with spreader stokers. But with the size boilers selected, light-load operation could be avoided entirely by proper load dispatching.

An idle stack 180 feet in height was available at the plant. But because we wanted proper dispersion of the combustion products, a new stack 300 feet high was constructed. In addition,

REQUIRED TEST DATA FOR GOOD OPERATION



1 Boiler efficiency plotted against different loadings shows that below 45% loading the unit efficiency falls off rapidly



2 High-load spreader operation requires a considerable air leakage in addition to normal fan-supply air for the cooling parts

a high-efficiency mechanical collector went in with each boiler to assure that only a minimum of fine dust would be discharged into the atmosphere.

A study of the station heat balance favored steam-driven auxiliaries throughout. To avoid waste of exhaust steam to atmosphere at low loads, an interconnection routes auxiliary exhaust steam directly into the city heating mains whenever an excess develops over that required for station use.

Both forced- and induced-draft fans mount upon a common shaft driven by a variable-speed turbine. In the absence of economizers and air heaters, such an arrangement results in a compact and economical installation.

Tests Performed. We found very little data of a definite nature to set up economical operating procedures for swing loads on spreader-stoker-fired boilers. What's more, we wanted certain information for planning new units. The only way to get this material was to run tests. Unfortunately, a coal strike delayed and hence forced a curtailment of some of the test work planned.

Tests were to (1) verify all specific guarantees given by the boiler and dust-collector manufacturers (2) determine the value of dust reinjection into the furnace (3) obtain data on maximum capacity (4) determine most economical banking procedures (5) obtain operating efficiency over the load range. Data on this last item was particularly desired to assist in economical load dispatching.

The Indianapolis Power & Light Co, in cooperation with engineers from Babcock & Wilcox Co and Detroit Stoker Co, performed all the tests.

Testing Procedures. *ASME Test Code for Steam-Generating Units* served as a primary guide for test procedure. Because boiler output could not be measured accurately, the heat-loss method prescribed by the code served as the prime measurement of efficiency. Input-output measurements were taken only as a check on heat-loss results.

Because a spreader-stoker grate carries a very thin fuel bed and we were using heat-loss methods as the prime measurement of efficiency, each test was limited to six hours. A 2-hr period at test load before each 6-hr run allowed conditions to stabilize. An analysis of the test results indicated 6-hr runs at high loads were long enough to provide accurate input-output measurements. At lower loads, however, six hours was insufficient to obtain input-output measurements of acceptable accuracy.

Two automatic coal scales per boiler measured coal input. Each scale recorded coal flow in dumps of 200 lb. Samples of coal, taken at 5-min intervals from the coal-scale belt, were stored in a milk can kept in a cool location. At the end of each test, the accumulated coal sample went through a sample crusher that automatically extracted a 5% sample. This reduced sample was further riffled down to provide samples for three laboratories.

It was intended to use a washed coal from a single mine throughout the testing period. Unfortunately, minor amounts of other coals had to be used. But results show that variations in coal quality over the period were not significant.

A commercial flowmeter, calibrated by water leg before and after testing period, measured the steam output. The flow nozzle provided with the meter was not calibrated. But at the time of installation all dimensions were carefully micrometered and a corrected constant obtained from the meter manufactured. While the two water-leg calibrations made before and after the testing period agreed well at high loads, wide discrepancies showed up at low loads. Since the second calibration gave a much better agreement with heat-loss calculations, we used it exclusively at lower loads.

We did not meter feedwater flow to the boilers. Since feedwater is 100% lime-soda treated, a blowdown flow of about 12% was maintained throughout the tests. We estimated blowdown flow from chemical analysis of the feedwater and blowdown water, and checked it roughly by the setting of the flow-control valve installed in the blowdown line. Correlation between the two readings was not good. Therefore blowdown flows and hence boiler-output measurements must be viewed with some suspicion.

We took the principal temperature measures at 15-min intervals by calibrated chromel-alumel thermocouples

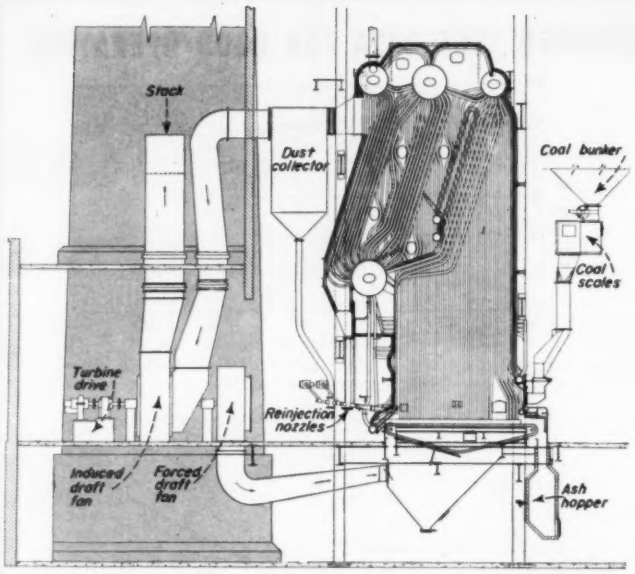
with a potentiometer accurate to 0.02 millivolts. Twice during each test, we ran a 24-point traverse at the boiler outlet with a calibrated chromel-alumel couple and a potentiometer accurate to 0.05 millivolts. The data from the traverses we correlated with the other flue-gas temperature measurements to obtain average flue-gas temperature at the boiler outlet during the run. In addition to the above thermocouple readings, all existing industrial thermometers and temperature recorders supplied information to assist in checking results. We used mercury-in-glass thermometers for air and fuel temperatures, and a sling psychrometer to measure humidity.

Aside from a calibrated-test pressure gage to secure steam pressure at the flowmeter nozzle, all other pressures and drafts were taken with board instruments properly calibrated before the tests. A differential inclined tube manometer mounted across an orifice in the forced-draft air duct gave us a check upon calculated air flows.

Full orsat gas analyses were taken at the induced-draft fan outlet at 15-min intervals throughout each run. Twice during each run we took a 24-point traverse at the boiler outlet for CO_2 only. Results of these traverses were used to transfer the fuel-gas analyses made at the induced-draft fan outlet to the boiler outlet. During two of the runs, traverses were made for CO_2 with a water-cooled probe at the furnace outlet simultaneously with the traverse made at the boiler outlet. This data served as a basis for estimating setting leakage for all runs.

Research Corp supplied standard dust-sampling apparatus to obtain samples. Two samplers used throughout the 6-hr run collected samples from 70 points at the dust-collector outlet. In view of the high flue-gas temperatures, alumdum filter thimbles were used. Prior to each run, a velocity traverse of all sampling points was made and corresponding flow rates for each sampling point were calculated. The sampled dust was analyzed for combustible and screen-size consist. Since we found it impossible to remove all dust from the thimbles we corrected screen size consist results upon the assumption that all material retained in the filter pores was minus 325 mesh in size.

With the exception of Run No. 2, all dust caught in the dust collector we reinjected into the boiler furnace for reburning. This reinjected dust was not sampled since we had no simple method available to secure a sample without disturbing the continuity of the dust flow.



3 Spreader stokers, handling peaking portions of process and steam-heating load, required tests to determine proper banking, reinjection amounts, smoke problems

In Run No. 2, inlet ports to the venturi nozzle, which normally pick up the dust for reinjection, were sealed off with rubber-lined sleeves. Thus in this run, although no dust was reinjected, air flow through the reinjection nozzles stayed the same as that normally existing during the other runs. Blast gates were already in place below the reinjection nozzles, and, by the addition of a blast gate in each of the three downcomer pipes just below the dust collector hoppers, we formed air locks in which dust could accumulate before being removed for weighing and sampling. A composite sample of this dust was analyzed for combustible content, heating value and screen-size consist.

Samples of the refuse discharged from the traveling grate were taken at 15-min intervals at the point of discharge into the ashpit. A composite sample was analyzed for combustible content.

In addition to the above readings, sufficient data were secured upon auxiliaries to permit the calculation of net efficiency of the unit.

Results. Table 1 presents a tabulation of test data and calculated results for the five efficiency runs. As stated previously, output measurements are subject to some uncertainty, and so we placed more reliance on gross efficiencies as calculated from heat losses than on those calculated from input-output measurements.

Several interesting points show up when nonreinjection Run No. 2 is compared with its companion reinjection Run No. 1. Flue-gas temperatures at the boiler outlet ran noticeably higher when reinjection was discontinued. It is likely that this higher temperature occurred because of (1) reduced burning in suspension in the furnace or (2) reduced tube cleanliness caused by the reduction in recirculated flyash.

In the nonreinjection run, note that carryover of flyash to the boiler outlet was 48% of the total refuse. Interesting when you compare this figure with the carryover of 60 to 70% normally found in wet-bottom pulverized-coal-fired boilers.

The tests indicate that about 3% additional coal is required to carry full load on the boiler when reinjection of collector dust is discontinued. Unfortunately time did not permit additional runs at lower loads without reinjection of flyash so the differential in coal consumption was not determined throughout the load range. Rough checks made at lower loads by momentarily cutting off reinjection indicated that an appreciable differential also exists at such loads.

The tests also show dust emission from the stack is about three times greater when reinjection of the col-

1: GENERAL TEST RESULTS—SPREADER FIRING

Run number		2	1	3	4	5
Collector dust reinjected into furnace		No	Yes	Yes	Yes	Yes
Output—percent of boiler capacity	%	100.8	100.6	69.1	47.4	20.4
Coal analysis (dry basis):						
Ash	%	10.6	10.9	11.3	10.8	10.8
High heat value (as fired)	Btu per lb	11,490	11,540	11,300	11,340	11,360
Refuse (dry) percent of coal (dry):						
Pit refuse	%	7.2	9.4	10.7	10.4	9.7
Dust-collector hopper refuse	%	5.9	—	—	—	—
Dust to stack	%	0.7	2.2	1.0	0.8	2.3
Combustible in dry refuse:						
Pit refuse	%	4.2	3.2	2.3	2.9	5.7
Dust-collector hopper refuse	%	45.1	—	—	—	—
Dust to stack	%	25.5	19.2	12.0	12.2	28.4
Excess air, boiler outlet	%	30.6	30.9	39.9	48.5	172.5
Overfire air header pressure	in. water	34.8	34.6	27.7	22.8	32.2
Steam-pressure boiler outlet	psig	248	247	255	248	254
Steam temp at boiler outlet	F	483	484	477	468	469
Flue-gas temp boiler outlet	F	623	618	557	508	474
Coal firing rate, as fired	lb per hr	18,300	17,767	12,200	8,167	3,933
Coal fired per sq ft of grate	lb per hr	57.7	56.1	38.5	25.8	12.4
Heat release per sq ft of grate	KB per hr	614	616	419	279	133
Heat release per cu ft furnace volume	KB per hr	27.1	27.2	18.5	12.3	5.9
Heat losses in percent:						
Dry gas and moisture in air	%	13.2	13.7	12.9	12.1	19.6
Moisture in coal	%	1.3	1.2	1.3	1.3	1.3
Water from combustion of hydrogen	%	4.6	4.6	4.8	4.5	4.4
Unburned gaseous combustible	%	0.0	0.0	0.0	0.0	0.0
Combustible in refuse	%	3.5	0.8	0.4	0.5	1.4
Radiation, convection (ASME curves)	%	0.6	0.6	0.9	1.3	3.0
Total	%	23.2	20.9	20.3	19.7	29.7
Over-all gross efficiencies:						
Output-input measurements	%	77.2	79.0	80.6	82.3	73.6
Heat losses	%	76.8	79.1	79.7	80.3	70.3

2: BANKING TESTS—FUEL AND SMOKE EXPERIENCE

Type of bank	Ready to serve in: minutes	Method of firing	Coal consumption tons per hour	Smoke emission on firing
Live	30	Intermittent (1 to 2 min in every 15)	0.9	Dense
Live	30	Continuous	1.0	Below No. 2 (expert firing)
Dead	120	Intermittent	0.1	Below No. 2

lector dust is practiced. Thus we may assume that a major percentage of the reinjected dust is recirculated back to the dust-collector inlet. While the increase in stack discharge is a definite disadvantage, the dust emitted is quite fine and, properly dispersed into the atmosphere from a tall stack, should cause no nuisance.

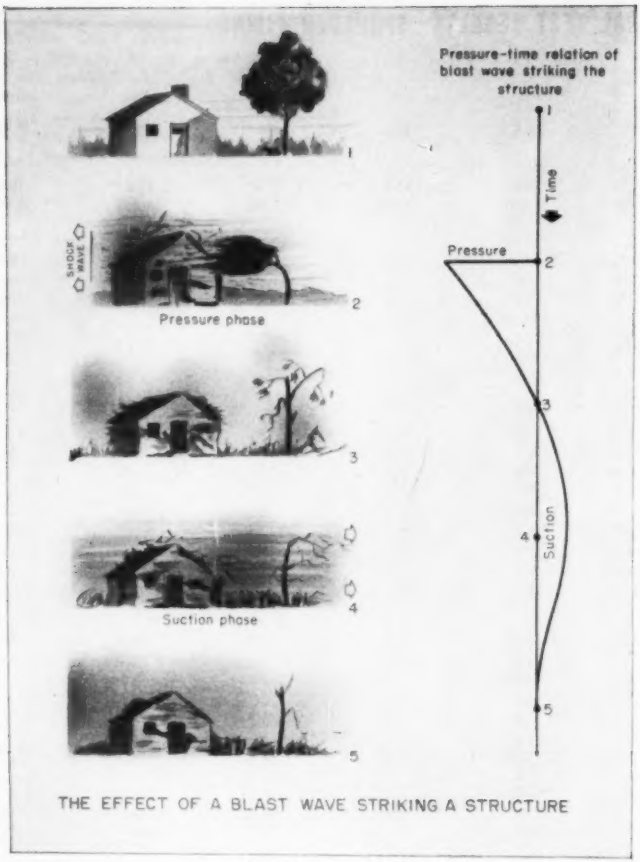
A plot of efficiency versus loading of the boiler, Fig. 1, reveals that efficiency falls off rapidly below about 45% capacity. This efficiency drop is due almost wholly to the increased percentage of excess air at these lower loads.

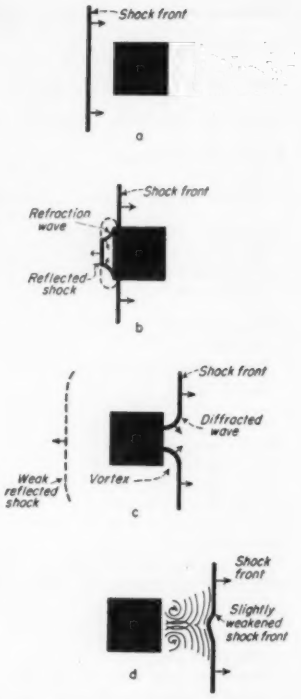
In Figure No. 2, estimated air flows over the test range are plotted. With spreader stokers at high loads, an appreciable amount of air must be allowed to leak in around the spreader mechanism to cool it properly in addition to cooling air which is forced in around the mechanism with a fan. Cooling air supplied from the fan at lower loads can be reduced. But during our tests this was not done. We found that at intermediate loads, the high-pressure over-fire air could be reduced. At low loads, though, we had this air supply wide open to avoid smoke.

As with any stoker, it is necessary to allow some small flow of air through the grates to (1) maintain proper distribution of air (2) avoid any tendency toward overheating the grates. This flow, together with overfire air, contributes to the large amount of excess air at low loads.

Air Pollution. Smoke emission in the

(*Continued on page 174*)





1 Blast pressure first pushes on front only, then on all sides of building

2 Working down from the top, match shock wave points with effects at left

How to Size Up the Atom Bomb—Part 3

By **PHILIP W SWAIN**, *Editor of POWER*

► PART 1, in October 1950, showed why engineers must assume technical leadership in protecting plant and community against atomic bombs. Part 2, November, viewed the bomb as a machine to radiate gigantic destructive forces. This final article will translate these mechanical effects into human and economic terms, show how the bomb will act on people and property.

All three articles include much of the formerly secret data just released by the Atomic Energy Commission in the book, *The Effects of Atomic Weapons.**

Except where more powerful bombs are specifically mentioned, all facts and comment in these articles refer to the "nominal" atomic bomb, equivalent to those detonated in Japan and at Bikini. This nominal bomb releases the energy of 20,000 tons of TNT, or 23,000,000 kwhr. About one-third goes out from the explosion as radiant heat, two-thirds as shock-wave energy and a small percentage as radioactivity.

*Paper-bound edition, $1.25 from the Government Printing Office, Washington, D. C. Cloth-bound edition, $3.00 from the McGraw-Hill Book Co.

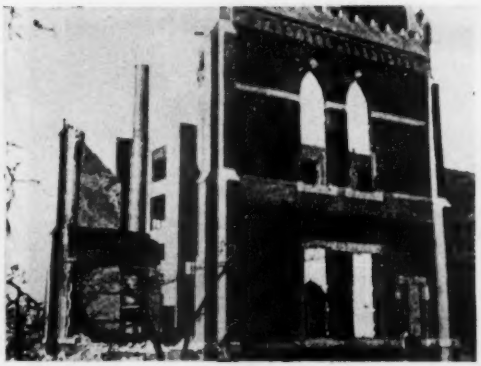
The experts agree that a high air burst is more effective against land targets than a low burst, or one beneath the surface of an adjacent river or harbor. That's why these studies are mainly concerned with an air burst 2000 to 2500 ft above ground. For this most destructive detonation level, the only radiations that need be considered are shock wave, thermal radiation and gamma rays.

Shock Wave. In viewing Fig. 2, think of time as moving down through the shock-wave profile pictured at the right. Also, match points 1, 2, 3, 4, 5 with the

CONCRETE AT 700 FEET

3 External walls were intact in reinforced-concrete building 700 ft from ground zero, 2100 ft (air line) from explosion

BRICK AT 5200 FEET



5 Load bearing masonry walls are easily demolished by shock wave. This brick wall failed at 5200 ft from ground zero

4 Interior of same building was burned out by post-blast fire. Note badly sagging roof and spalling of the plaster

6 Interior of same building shows complete destruction by blast and subsequent fire. Compare with concrete at left

This concluding article shows how shock wave, flash and gamma rays act on people and structures. Here are the foundation facts underlying your measures to protect plant and community

sketches at the left. All is peaceful (1) until the shock front strikes (2) with its peak pressure and peak wind velocity. House, trees and dog are pushed violently to the left, away from the bomb. In about one second, pressure dies to normal and wind ceases (3) as wave slides through zero into the negative phase (4). Now pressure has changed to suction and wind blows in the reverse direction. Less violent than the positive phase, this negative phase lasts longer, several seconds. Then (5) calm is restored; the wave has moved on to do its work on more distant targets.

The pressure phase is 800 to 1000 ft long and travels somewhat faster than sound (sound travels 1100 ft per sec.). For data on pressures and wind velocities at various distances see table on page 87.

In Fig. 1 note how the hypothetical building is first pushed only on its front face by the peak pressure at the shock front. A moment later the plus phase has enveloped the whole building so the backpressure nearly balances the forward pressure. Wind drag still acts on the building, and the enveloping outside pressure tries to collapse it.

Considering all the target areas involved, most of the shock damage is done by pressures less than 15 psi and greater than 3 psi.

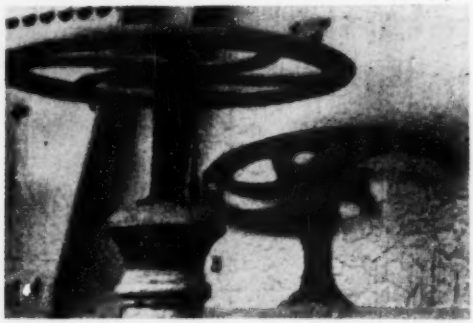
In evaluating these pressures remember that hurricane wind pressure is far less than 1 psi. On a wall 20x20 ft, 5 psi exerts a total force of 144 tons. This pressure would push 4300 lb on a window pane 2x3 ft.

How Blast Affects Buildings. Factors affecting blast damage include peak pressure at shock wave front; size and shape of buildings; strength of framing, walls and roof; window area and many others. As to shape, round objects are more resistant to blast because of low wind drag and the rapid equalization of pressure on the far side. Reinforced concrete stacks stood up well in Japan.

Large glazed areas in building walls

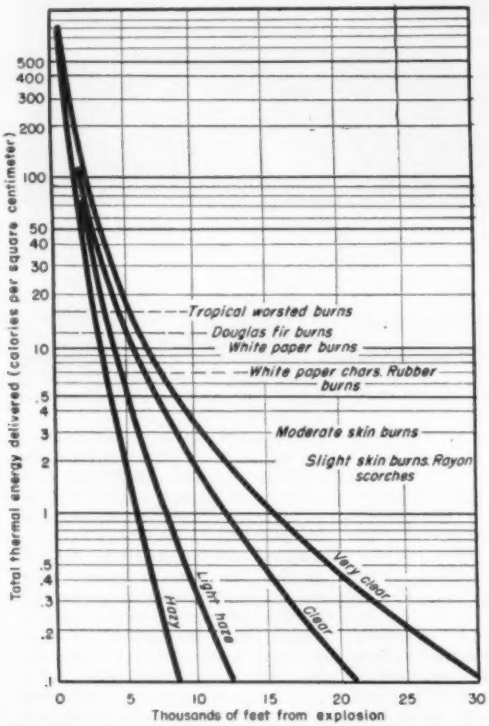
RADIANT HEAT

7 Close to ground zero the dark pattern in kimono absorbed enough radiant heat to burn the pattern into patient's skin



8 Paint on gas holder, 7000 ft from ground zero, scorched by the heat rays except where protected by shadow of valve

9 Light parts of this exposed material are intact, but thermal radiation has destroyed some of the dark-colored stripes



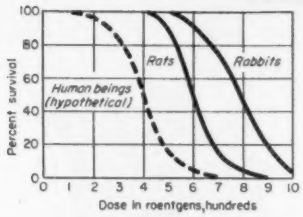
10 Thermal energy delivered through various air line distances on days of different atmospheric visibility

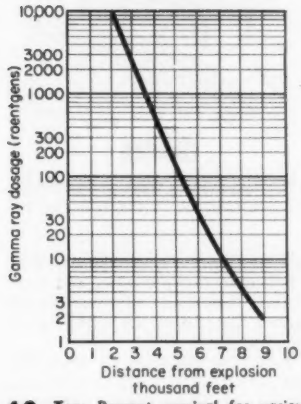
GAGE THE HEAT FLASH WITH CHART AND TABLE

Material	Effect	Critical energy	Effective distance	
		Calories per sq. centimeter	Clear day *Feet*	Very clear *Feet*
Skin	Moderate burns	3	8, 400	10, 000
	Slight burns	2	9, 600	12, 000
White paper	Chars	8	6, 000	7, 000
	Burns	10	5, 400	6, 300
Black paper	Burns	3	8, 400	10, 000
Douglas fir	Chars	8	6, 000	7, 000
	Burns	11	5, 200	5, 900
Douglas fir (stained dark)	Burns	3	8, 400	10, 000
Philippine mahogany	Chars	7	6, 300	7, 300
	Burns	9	6, 150	7, 150
Maple (black)	Chars	8	6, 000	7, 000
	Burns	25	3, 800	4, 300
Cotton shirting (gray)	Scorches	8	6, 000	7, 000
	Burns	10	5, 400	6, 300
Cotton twill	Scorches	10	5, 400	6, 300
	Burns	17	4, 400	5, 100
Gabardine (green)	Brittle	7	6, 300	7, 300
	Burns	10	5, 400	6, 300
Nylon (olive drab)	Melts	3	8, 400	10, 000
Rayon lining	Scorches	3	8, 400	10, 000
	Burns	8	6, 000	7, 000
Wool serge (dark blue)	Nap gone	2	9, 600	12, 000
	Loose fibers burn	7	6, 300	7, 300
Worsted (tropical khaki)	Nap melts	4	7, 600	9, 100
	Burns	15	4, 700	5, 400
Rubber (synthetic)	Burns	8	6, 000	7, 000
Lucite	Softens	72	2, 300	2, 400
Bakelite	Chars	75	2, 300	2, 400

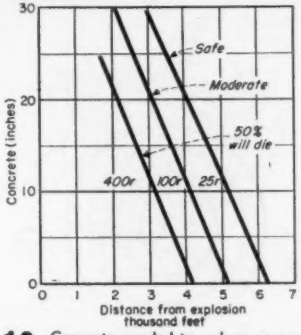
11 Energies required to produce various incendiary effects, with the corresponding air-line distances from the bomb

GAMMA RADIATION

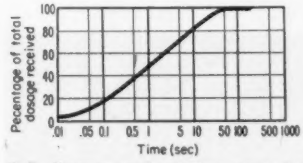




12 *Top:* Percent survival for various doses. *Bottom:* Effect of distance



13 Concrete needed to reduce gamma radiation intensity to specified values. To get equivalent thicknesses, multiply concrete thickness by 0.14 for lead and by 1.7 for well-packed earth



14 Percent total radiation received in various periods of time after blast

are both an advantage and a disadvantage. Breaking of these large glass areas allows pressure to equalize quickly inside and out, thus protecting the walls from crushing. On the other hand, flying glass can kill and maim occupants. Brittle asbestos siding will also relieve wall pressure, probably with less missile hazard.

It sometimes happened in Japan that all floor slabs were intact except that of the ground floor. Broken windows had equalized pressure above and below all the other floors, but the atmospheric pressure in the closed basement could not support the ground floor against the downward thrust of the shock pressure.

In Japan the most vulnerable structures, aside from the flimsy homes, were buildings with brick bearing walls and sawtooth-roof factories of light steel construction.

Buried piping and other underground construction suffered little damage, but thousands of leaks in damaged buildings left little water for fire-fighting.

Damage Vs. Distance. Table on page 87 sums up observations made in the Japanese cities. The effects would not differ greatly if the same bomb were exploded over an American city except that total deaths, casualties and property loss would vary widely with the concentration of population and property. Damage will be practically complete up to half a mile from ground zero, severe to one mile, moderate to 1⅝ miles, partial to 2 miles, and light to 8 miles.

Close to ground zero, damage may be greater to roofs than to walls because of the high angle of incidence. Even 2500 ft from ground zero the various bomb effects will arrive on a 45-deg slant from a bomb detonated 2500 ft above ground. The vertical component will be important as far out as 4000 or 5000 ft.

The Japanese experience does not clearly show how tall steel-frame buildings will stand up against the atom bomb. Only one such was exposed in Nagasaki—4500 ft from the bomb. Except for the crushing of its thin concrete roof this building was not harmed.

The Effects of Atomic Weapons suggests that American skyscrapers would be fairly resistant, but fails to clarify an important point. Would not flying glass cause many casualties inside and out, and would not terra-cotta and brick facings become dislodged to injure many in the streets below?

Utilities. In Nagasaki there was little breakage of underground water mains or electrical conduits, but thousands of broken pipes in damaged buildings dried up the water supply. Overhead electrical facilities suffered heavy damage—up to 10,000 ft. Switchgear and transformers were resistant to the blast, but were often damaged by debris and collapsing buildings.

Fire damaged many motors and generators. Gas holders suffered heavy damage up to 6000 ft. The escaping gas took fire, but there was no gas explosion. Underground gas mains were not affected.

Thermal Radiation. Like any other hot object, the atom bomb radiates heat, in this case the equivalent of 8,000,000 kwhr—about one-third of the bomb's immense total energy release. Dosage delivered is affected greatly by atmospheric clearness, as well as by distance. Table on page 84 shows that 3 calories per square centimeter will cause moderate skin burns. This amount will be delivered as far out as 10,000 ft in exceptionally clear weather, and out to 8400 ft on a moderately clear day.

With the curves in Fig. 10, this table will enable the reader to estimate the range of various incendiary effects on clear, average and hazy days.

It is important to remember that heat rays, unlike gamma rays, are easily blocked by anything that throws a modest shadow. The burning radiation holds fairly steady for about three seconds. Thus a well-instructed person will throw his face and hands into the shadow of his body within one second after sensing the flash. Using his body as a shield will cut his thermal exposure by two seconds and perhaps save his life.

In the two Japanese cities from 20 to 30% of the fatalities were traceable to such flash burns as distinct from ordinary flame burns received in subsequent fires.

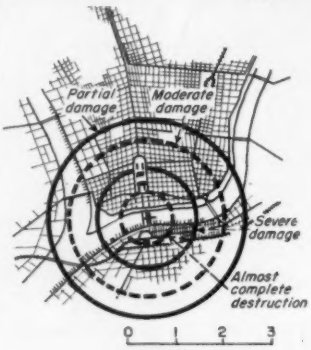
The direct and indirect incendiary effects of the bomb form a complex pattern. Wood, cloth or other combustible exposed to the heat rays may burst into flame. A few seconds later this flame may be snuffed out by the shock wave. Then the shock wave itself turns incendiary, ripping boiler furnaces open, upsetting stoves, fracturing gas mains and cutting electrical circuits, thus setting thousands of fires.

Ranging out for about a mile from ground zero these combine to make one vast conflagration. Hot air rising from several square miles of burning buildings causes high winds to sweep in from all directions, thus feeding the central fires while blocking their spread to outer areas. Many people who escape

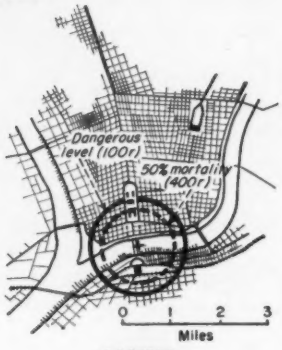
CIRCLES

Remember that circles are the key to atom-bomb understanding. To study the probable effects of a nominal A-bomb (equal to 20,000 tons TNT) on your own industrial area, redraw circles at the right on tracing paper to proper scale. Then lay tracings over your local map.

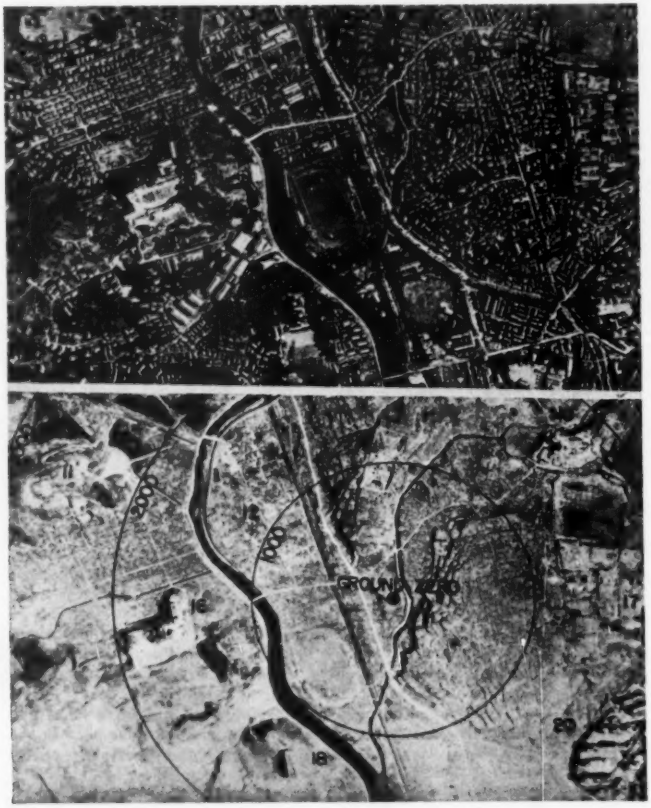
AIR BURST



16 Damage limits in imaginary city subjected to high-air atom blast



17 Approximate limits of initial nuclear radiation dosage, high air burst



15 Ground zero at Nagasaki before and after the atom-bomb explosion. The circles show distances from ground zero in feet. People killed here totaled 36,000

flash burns will be injured by these fires.

It is clear that preventing and extinguishing these fires, and preventing and treating these burns, are matters of supreme urgency.

It may be necessary for firefighters and rescue teams to abandon the central circle of almost total destruction and concentrate on areas farther out. There won't be enough firemen and equipment to handle fires near ground zero even if this area could be entered while fires are blazing. At Hiroshima, 70% of the firefighting equipment was crushed in the collapse of the fire houses, and 80% of the firemen were unable to respond. Also, leaks practically eliminated water for firefighting.

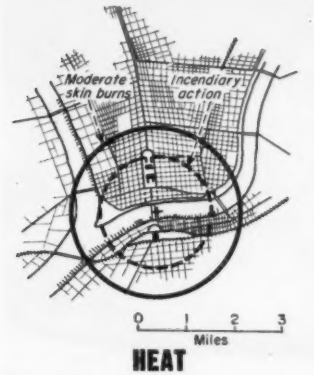
Several lessons can be drawn from this terrifying experience. One is that most of the firefighting must be handled by men and facilities from outlying areas, and that these must concentrate first on the fringe fires, then work in as far as practicable.

Another lesson is the obvious need for a city water system so laid out and valved that water won't run to waste in damaged buildings that cannot be reached. Finally, vital war-production plants should be protected by completely self-contained facilities, their own wells or storage ponds, their own engine-driven pumps, with their own fuel storage—all well shielded against both blast and fire.

Gamma Rays. The explosion of an atom bomb sends out four kinds of nuclear radiations: alpha, beta, gamma and neutrons.

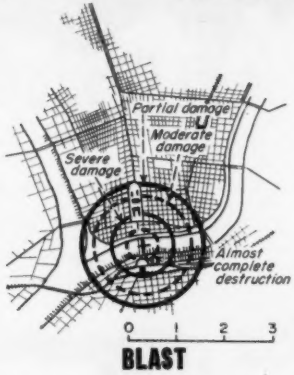
Residual radiation in fission products and exposed matter may be neglected if the bomb is detonated at high level, as is most likely. Experience in Japan

UNDERWATER BURST



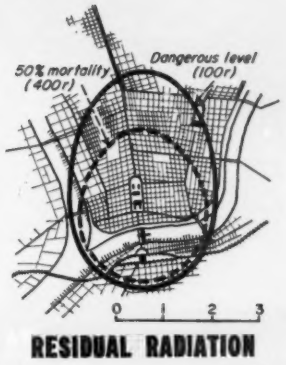
HEAT

18 Approximate limits of thermal radiation effects for high air burst



BLAST

19 Approximate limits of damage by air blast from underwater burst



RESIDUAL RADIATION

20 Approximate limits of residual radiation from the underwater burst

and observations at Bikini show that this poisonous matter is harmlessly dispersed by the strong updraft in the "mushroom" cloud.

Of the direct nuclear radiations from the bomb burst the alpha and beta rays may be neglected because they do not penetrate to the earth's surface. Even the neutrons, which can be deadly up to 2500 or 3000 ft, can be disregarded because anybody exposed to neutrons at this distance would certainly be killed by the more powerful gamma rays.

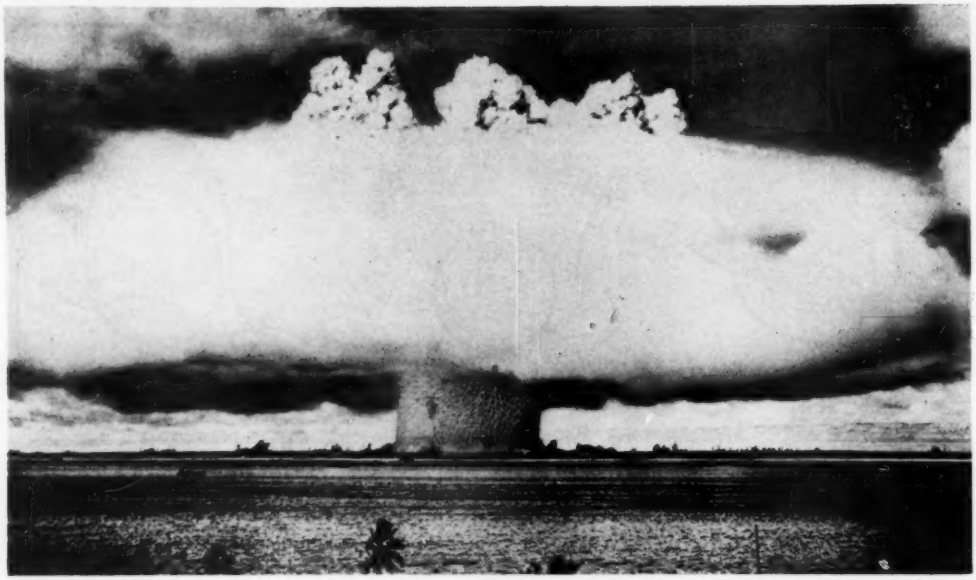
Of 100,000 people killed by the two atom bombs in Japan, about 15,000 were destroyed by the gamma rays. There were no known injuries from residual radiation. The unit of gamma-ray dosage is the roentgen (symbol R). For radiation received within a short span of time the "median lethal dose" is about 400 R. Thus, if a group of unprotected persons is exposed at an airline distance of 4200 ft, the gamma dosage is 400 R, and about half will die within a month or two. The other half will recover completely.

Fig. 13 shows what thickness of concrete gives various degrees of protection. Note that 400 R implies a fifty-fifty chance of living. At 100 R survival is fairly certain, and 25 R is definitely safe. Other heavy materials can replace concrete as a gamma shield if the thickness is suitably adjusted. To get equivalent thicknesses, multiply concrete thickness by 0.14 for lead and by 1.7 for well-packed earth.

Note also that each 5-in. layer of concrete (or 0.7-in. layer of lead or 9-in. layer of earth) cuts gamma intensity in half. Thus tripling these unit thicknesses would reduce intensity to $\frac{1}{2}x\frac{1}{2}x\frac{1}{2}=\frac{1}{8}$ strength. These relationships

AIR BLAST DAMAGE: JAPANESE EXPERIENCE

Wind velocity (miles per hr.)	Duration (sec)	Peak pressure (psig)	Miles	Feet	Damage
					Limit of light damage at 8 miles.
50	1.25	1.5		12,000	← Light damage to window frames and doors, moderate plaster damage, complete window damage.
			2.25		
60	1.23	1.7		11,000	← Flash charring of telegraph poles. Roof and wall covering on steel frame building damaged.
			2.0		← Partial damage to structures in area.
70	1.20	2.0		10,000	← Blast damage to majority of homes. Severe fire damage expected. Flash ignition of dry combustible materials.
			1.75		
80	1.15	2.4		9000	← Heavy plaster damage.
					← Moderate damage to area.
100	1.12	2.9		8000	← Severe damage to homes, heavy damage to window frames and doors, foliage scorched by radiant heat.
			1.50		
125	1.06	3.6		7000	
			1.25		← Structural damage to multistory brick buildings.
160	0.98	5.2		6000	← Severe damage to entire area. Severe structural damage to steel frame building. 9-inch brick walls moderately cracked.
					← Electrical installations and trolley cars destroyed.
			1.0		← Multistory brick building completely destroyed.
200	0.90	7.4		5000	← 12-inch brick walls severely cracked.
					← Steel frame building destroyed (mass distortion of frame).
					← Light concrete buildings collapsed.
270	0.77	10		4000	← Reinforced concrete smoke stack with 8-inch walls overturned.
			0.75		← Roof tiles bubbled (melted by heat).
					← 18-inch brick walls completely destroyed.
380	0.62	16		3000	
			0.50		Virtually complete destruction of all buildings, other than reinforced concrete earthquake-resistant design.
550	0.45	24		2000	← Limit of severe structural damage to earthquake-resistant reinforced concrete buildings. Reinforced concrete building collapsed, 10-inch walls, 6-inch floor.
					← Mass distortion of heavy steel frame buildings. Loss of roofs and panels.
			0.25		
800	0.37	36		1000	← Decks of steel plate girder bridge shift laterally.
					← "Ground zero" for Air Burst of an Atomic Bomb.



21 Early stage of underwater burst at Bikini. Plume, rising to 8000 ft, is hollow watery shell 2000 ft dia, 300 ft thick. Mist is temporary "cloud chamber" effect, created by sudden expansion and cooling of air as shock wave passes by

are worth memorizing as rules of thumb for emergency use when no reference charts or tables are available.

Since the high air burst leaves no dangerous residual radioactivity it may be asked why it is considered more effective and, therefore, more probable than an underwater burst. Here are several reasons:

1. The underwater burst wastes much of its energy in lifting water.

2. Since the bomb is in a harbor or river much of the area of heavy potential damage will contain no targets.

3. Thus shock-wave damage is greatly reduced.

4. Radiant-heat casualties are eliminated.

5. Initial gamma radiation is blocked by the water.

Unlike the high air burst, the underwater does distribute dangerous residual radiation over a wide area (Fig. 20) but the contaminated water will fail to enter many structures protected by closed windows. Under expert radiological guidance many persons may be able to leave their working places after the blast and get out of the area before receiving a deadly dose of radiation.

To sum up, an underwater blast would indeed be a terrible catastrophe, but would kill fewer persons than a high air burst, and do very much less damage.

Fig. 16 to 20 map the effects of air and underwater burst on a hypothetical city. You can redraw the damage circles on tracing paper to the scale of your local maps, then center them over various points to study the vulnerability of your plant and of other possible targets. You may then find yourself on the edge of a target area with the threat all from one side. Assuming a burst 2500 ft up, a little work on the drawing board will indicate how present and additional shielding can serve to block the blast, flash and gamma rays.

But be warned against unnecessary alarm. Small communities and solitary plants of small and medium size will be safe. Atom bombs will be used only against big-area targets, wide expanses of industrial and commercial buildings in the big cities, giant industrial plants covering many hundreds of acres and employing tens of thousands of people. The enemy will aim to find a 3- or 4-mile circle solidly full of vital objects or people.

The Effects of Atomic Weapons includes data useful in the design of new buildings and the strengthening of old to resist atom bombing at distances beyond 4000 ft. It will rarely pay to attempt protection for a closer blast.

Protection of people against flash burns will be the simplest. For those indoors any form of shading will serve.

It will be much harder to guard against injury by flying glass. Pasting muslin on windows, effective against TNT bombs, will be useless against the A-bomb. If wire glass is covered with wire mesh, securely nailed, windows will still fail but fewer cuts will result. Where practicable, the best solution is removing people from the vicinity of exposed windows.

Within 4500 ft, massive shielding by concrete, earth or lead is the only protection against gamma rays.

Other World Dangers? It has been suggested that any war involving the detonation of large numbers of atomic bombs will so poison the atmosphere with fission products as to render the whole world uninhabitable. Such a catastrophe would require detonating about one million bombs within a relatively short period—in practical terms, an impossibility.

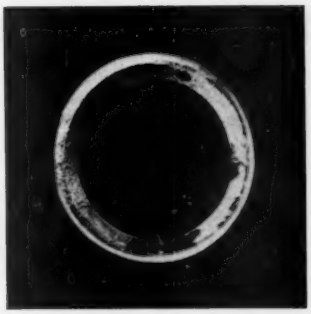
It must be admitted, however, that setting off a substantial number of atom bombs in one locality could cause a dangerous concentration of residual radiation for an appreciable time in the surrounding area.

To Sum Up. These three articles are not intended to supplant civil-defense instructions. Rather, they aim to give the engineer reader a fundamental understanding of what the bomb does to people and structures so that he can see beyond the civil defense rule books and be competent to exercise local and plant leadership in the technical phases of atom-bomb protection.

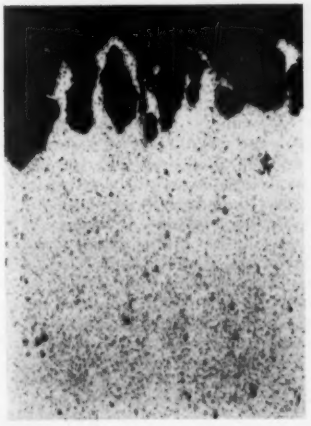
Acid Cleaning: Power-Plant Maintenance Tool

Here's a roundup on acid cleaning — its different methods, applications, controls, advantages, by an acknowledged leader in the field*

By Sheppard T Powell, *Chemical Engineer*



1 Corrosion attack of a cleaning acid shows up at the rolled ends of tubes



2 Honeycomb pattern, shown in Fig. 1 and here, identifies corrosion attack

► ACID CLEANING of power-plant equipment has become a highly specialized art. With properly trained personnel and correct equipment you can get satisfactory results with little or no hazard. In fact, experience has been so good that practically any power-plant equipment can be acid-cleaned.

Remember, studies of metals repeatedly acid-cleaned show some corrosion takes place each time. But, in general, the rate is so slow it presents no serious problem. The best single way to judge what effect acid cleaning has on your own equipment is to run a before-and-after test. That is, inspect and evaluate the equipment by visual means. Wire brush the surfaces or apply a weak acid locally so you can check for pitting under low magnification and also with tangential illumination.

Pitting shows up on stressed metals. So look at rolled ends of the tubes, Fig. 1; heads or nuts of highly strained bolts, Fig. 3; bends of angle irons, welded zones. These same parts experience the strongest corrosion attacks by the cleaning acid. Examine them well before cleaning and then after. Fig. 1, 2 show the honeycomb type of attack characteristic of this action. Cold-rolled parts within the drum seem to be readily attacked. The same holds for ordinary black pipe, especially if it is cold-worked, Fig. 4. Bear in mind these parts are relatively minor in the average boiler, but they are mentioned to give a convenient, although extreme, check on the effect of acid cleaning.

Cost of Cleaning. How much will it cost? You can't pin down the cost of acid cleaning to any flat figure because the power equipment in plants varies so much and so do the deposits to be removed. But you can compare it with other cleaning methods. In power-plant work the only other method is mechanical. Chemical cleaning should get credit for less labor, reduced outage of equipment, minimum replacements, such as the minor parts like black piping, caps. Next, remember that some equipment can't be cleaned any other way.

Cleaning Technique. Before any cleaning program starts, inspect and evaluate all conditions. Actual treatment needed depends on chemical characteristics, density, porosity and thickness of deposits. To evaluate these deposits properly means both chemical and microscopic examination and identification by X-ray diffraction patterns. Too many power-plant operators feel that all acid cleaning amounts to is the use of a mineral acid containing an inhibitor. But often there are deposits like silicate or sulfate that won't dissolve in muriatic acid. Experience demonstrates that acid cleaning can be made more effective by adding: (1) other compounds (2) frequently a wetting agent (3) an inhibitor. To determine just which compounds work best requires a background of practical experience.

Once the nature of the cleaning problem is known the strength and quantity of acid, as well as any supplementary chemicals, can be selected. If an outside contractor does the job he usually brings a fully prepared solution in specially designed tank wagons. The usual procedure, no matter who does it, is about that of table on p 90.

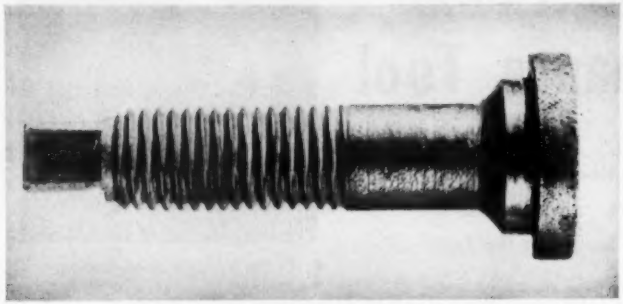
For a boiler the solution is pumped in through the bottom connection until it reaches the desired level. Then it may be circulated continuously or intermittently or just allowed to soak. Samples of the cleaning solution are pulled out from time to time to test for concentration of active constituents. All portions of the boiler such as nondraining superheaters should be completely isolated before cleaning starts.

Superheaters, Economizers. Where you absolutely have to chemically clean a nondraining superheater, flush out each tube individually with clean water, properly neutralize the surface after the cleaning and again purge with clean water. With an economizer, pump in the solution and hold it in the unit for a given period of time. Then flush and clean out as you did with the superheater.

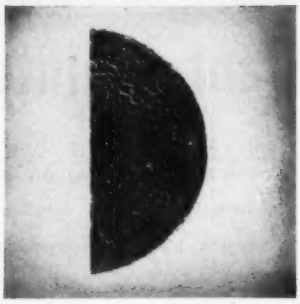
Spent-Acid Disposal. There are many laws and ordinances prohibiting the discharge of highly concentrated acids or alkalies into city sewers or into streams without neutralization. If this neutralization is impracticable it is sometimes possible to secure a permit

*Abstracted from the forthcoming McGraw-Hill book, *Boiler Feedwater Purification*, by S T Powell

STRESSED METALS GIVE EXTREME BUT READY CHECK ON EFFECT...



3 Too-hot acid cleaning can seriously damage boiler metals, above and at right. Trend now is to carry out the cleaning at temperatures somewhere around 140 F



4 Allowing enough time for the cleaning at lower temperatures avoids attack

for disposal by discharging waste liquors into tanks. Then the waste can be released at a slow discharge rate so no damage occurs to city sewers or surface-water streams.

Influencing Factors. A number of factors influence the effectiveness and safety of acid cleaning. Where possible these factors should be controlled. Chief among them are: (1) composition and concentration of acid (2) nature and composition of inhibitor (3) temperature of metal and solutions (4) circulation, mechanical or diffusion (5) composition of metal (6) physical and chemical composition of scale (7) hazards of process (8) procedure.

In the past, acid strength has run as high as 15%. Recently there has been a marked trend to acid of a lower concentration, from 4 to 7 %. Where silicates or sulfate scales are found, hydrofluoric acid or other fluorides are added.

Until recently, though, practically all acid cleaning has been with inhibited hydrochloric acid. It is very effective in removing deposits but has definite limitations as well as certain objectionable after effects. For instance, cleaning temperature should not run over 140-160 F, preferably 140. What's more, the clean surfaces quickly corrode and oxide films form on them if left exposed to the air.

Phosphoric acid has come into use as

RECOMMENDED METHODS FOR ACID CLEANING

I: ACID-CLEANING PROCEDURE—Soaking Method (Most Commonly Used)

1. Drain unit, cool, inspect, open vents
2. Add water to adjust metal temperature (about 140 F)
3. Drain
4. Fill with inhibited acid
5. Soak for a predetermined time
6. Continue tests for reduction in strength of acid (If concentrations drop rapidly and continue to fall, drain and refill with solution.)
7. Drain unit after soaking time is up
8. Flush two or three times by pumping in feed water and draining. Be guided by pH readings
9. Drain boiler, refill with 1-2% alkali solution (soda ash or caustic soda)
10. Drain, fill with feedwater above level in top drum reached by acid, drain to normal level
11. Heat with slow fire, steam at 10-25 psi for 2 hr or more
12. Empty boiler completely, if it is to be inspected. Otherwise, lower concentration by blowing down, adding feedwater
13. Never open manhole covers or inspection plates until all purgng and flushing have been completed

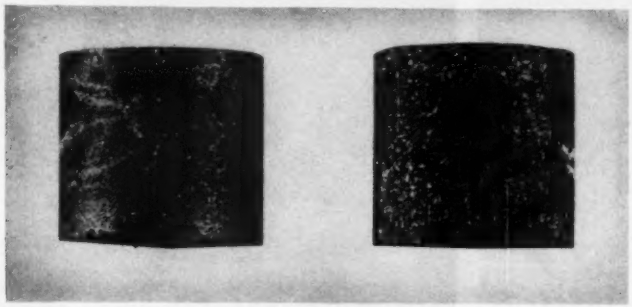
II: PHOSPHORIC-ACID CLEANING—Whirl & Purcell, Duquesne Lighting Co

1. With trisodium and sodium sulfite boil out solution for 24 hr at 244 psi
2. Boil out with inhibited phosphoric acid at atmospheric pressure for 8 hr
3. Alkalize and surface condition with a tetrapotassium pyrophosphate, potassium hydroxide and potassium sulfite solution for 12 hr at 246 psi

III: COMBINATION ACID CLEANING—Dowell

1. Boil out with sodium phosphate, soda ash, Dowell detergent
2. Drain
3. Flush, refill superheater with water
4. Preheat boiler to 165 F
5. Admit inhibited hydrochloric acid for rust and mill-scale removal
6. Neutralize with alkaline solution
7. Purge with nitrogen
8. Drain
9. Boil out with 0.1 phosphoric-acid solution
10. Drain while still hot
11. Keep boiler open while draining
12. Do not flush with water until ready to fill up boiler for starting

...OF ACID CLEANING ON BOILER SURFACES



5 Cold-rolled parts as well as ordinary black pipe, above, seem to be readily attacked. Use them as a convenient check on the effect of the acid cleaning

a result of these objections, table on p 90. It can be boiled by direct firing of the unit because its inhibitor stays effective at boiling temperatures. Circulation set up by the boiling action promotes distribution and supplies enough acid at all times to desired points. Further, the phosphoric acid passivates —that is, forms a protective film over the metal, so it does not rust after treatment.

Still another variation from the hydrochloric-acid technique is a combination of hydrochloric and phosphoric acids, table on p 90. It is said to be cheaper than the phosphoric method. The hydrochloric acid removes the deposits and the subsequent phosphoric-acid treatment passivates the metal.

Inhibitor's Nature, Composition. A great number of organic and inorganic substances have inhibiting properties. Most are harmless but some, like the compounds of arsenic, cyanide, sulfide and some coal tar products, are hazardous. Practically, selection of an inhibitor should be left to experts.

There are two general concepts of how inhibitors protect metal in contact with acid. One has it that iron goes into solution at anodic regions to form ions. Hydrogen in equivalent amounts leaves at the cathode areas. Most inhibitors are bases or positively charged so they travel to the cathode areas and deposit out on the surface. When this happens the electrochemical process stops because the layer of inhibitor deposits has stifled it. Presence of this inhibitor film raises the hydrogen over-voltage way above any potential that could exist in the acid-metal system.

A second explanation has the inhibiting compounds blanketing the entire metal surface. This occurs as a simple adsorption of the inhibitor ions on the metal surface. The nitrogen atom, a component of most organic inhibitors, plays a big role in this adsorption because the stereochemical structure controls the degree of concentration.

Others have gone farther and contend that inhibiting substances form a nonpermeable blanket through which hydrogen cannot diffuse.

Some claim that neither the electrochemical theory nor the impervious film on oxide free metal is the true explanation. As proof test results are cited. They indicate inhibitors are adsorbed simultaneously on both metal and oxide surface. But the formation is heavier on the clean metal surface, although it is of a porous nature. This porous formation causes a reduced diffusion and migration velocity of hydrogen and acid radical ions active in the corrosion of iron in an acid solution. The result is a greatly slowed-down corrosion attack.

Further there is the contention that corrosion during cleaning with inhibited hydrochloric acid is due to the formation of ferric chloride. This is a highly aggressive salt that oxidizes metallic iron and copper to the ionic form despite the presence of the ordinary inhibitors. Any metallic copper present forms cupric chloride, a secondary oxidizing source.

Constant circulation of the cleaning solution has been offered as a way of limiting ferric chloride concentration to a point below which active attack takes place. But there is no assurance that this method works. If ferric chloride pockets or otherwise concentrates but remains quiescent, reaction may proceed a lot slower because diffusion is the only means of carrying away the products of the reactions. Whatever the role of ferric chloride and copper, proper care permits acid cleaning of any equipment at repeated intervals.

Effect of Temperature. Possibly the most controversial factor in carrying out acid cleaning is temperature. Many cleanings have been carried out at 170 to 180 F. But the trend is away from that, nearer 140. There are many examples of handhole caps in waterwall headers damaged by too hot an acid cleaning. If enough time is allowed for cleaning, lower temperatures give excellent results.

Circulation. There is not enough evidence at hand to prove which methods—circulation by pump or by diffusion and thermal currents—produces the most satisfactory cleaning.

Hazards involved are negligible if experienced and trained personnel perform the cleaning. But for the untrained there are several hazards in addition to the natural corrosiveness of the acid. There is the real danger of fire and explosion from hydrogen. Measures need to be taken to prevent hydrogen escaping into the atmosphere in an enclosed space. Never let any sparks or open flames get near equipment being acid cleaned.

TURBINE-BLADE DEPOSITS

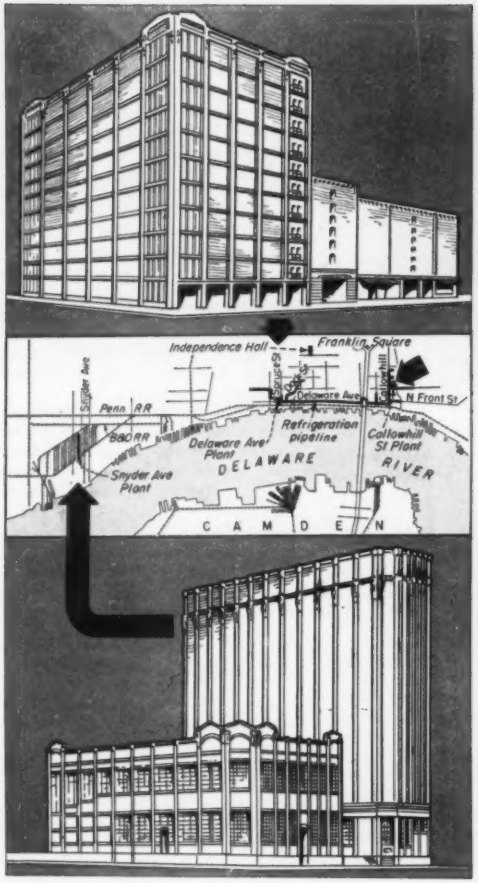
Even before the high-pressure boiler came along deposits on the blades of steam turbines caused headaches. But in those days improved boiler design and effective steam scrubbers solved the problem. Today, new types of deposits are getting over to the turbine blading. They are largely siliceous compounds, not water soluble.

Extensive research is now under way to determine ways and means of controlling these deposits. If you could condition water so no silica was present and no contamination got in through condenser leakage, the problem would disappear. But s' close a control is almost impossible to get. Straub and Grabowski* showed: "that plant tests indicate when silica (in the water) is kept below 5 ppm and pH around 11.0 no appreciable silica deposits form in turbines." But when silica in the steam gets above 0.1 ppm, deposits form. Studies have been made to reduce soluble silica in water by adding chemicals like magnesium to precipitate silica as a sludge.

Where deposits do form in turbines in enough quantity to cause trouble, the turbine should be cleaned. Methods are mechanical, washing with water, caustic washing. Where deposits are

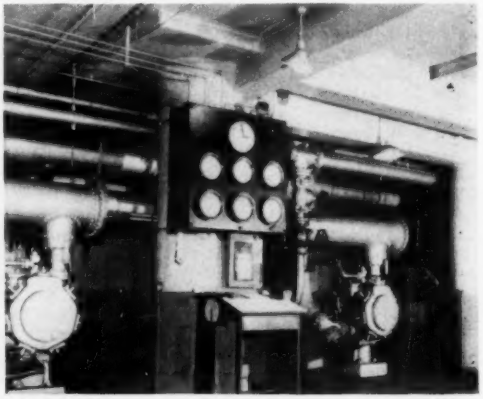
*Silica Deposition in Steam Turbines, F G Straub, H A Grabowski, Transactions ASME, July 1945, p 314.

Continued on page 164



1 Top: Delaware Ave and Spruce St plant. Lower: Snyder Ave plant. Callowhill St plant not shown. Map shows pipeline

2 William Brownlow, VP in charge of operations, looks over the 16-point temperature recorders for cold-storage rooms



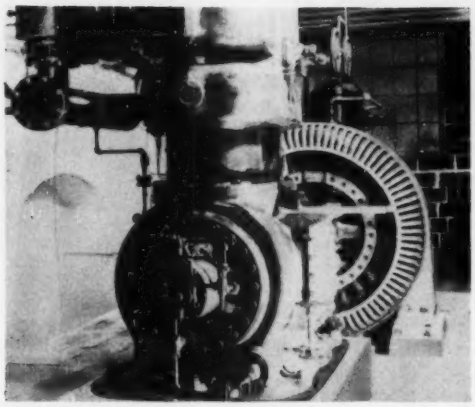
5 Three 100-ton horizontal compressors in Snyder Ave plant serve cold-storage loads in the large windowless building

How Three Refrigeration Plants Serve

BY WILLIAM BROWNLOW, *Vice-President in Charge of Operations*
Quaker City Cold Storage Co, Inc

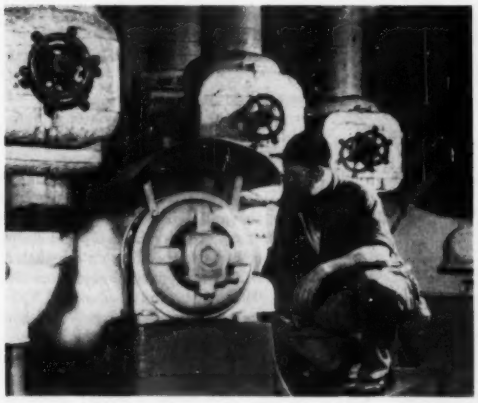
Here's an operating story that gives pointers and procedures for large cold-storage plants. It also gives details of the not-too-common central refrigerating plant with brine pipelines that supply cooling to commercial establishments over a wide area. Try some of the methods in your plant and save

► GOOD OPERATION of refrigerated warehouse machinery and equipment requires plenty of know-how. But you've got a real operating problem if you take any large cold-storage plant and hook eight miles of brine piping to it, to serve more than 125 stores, markets, restaurants and shops. That's the job Quaker City Cold Storage Co, Inc, Philadelphia, does and has done well for nearly 50 years. Before going through the plants to learn how they do their job, let's take a quick look at the outside services of two of them.

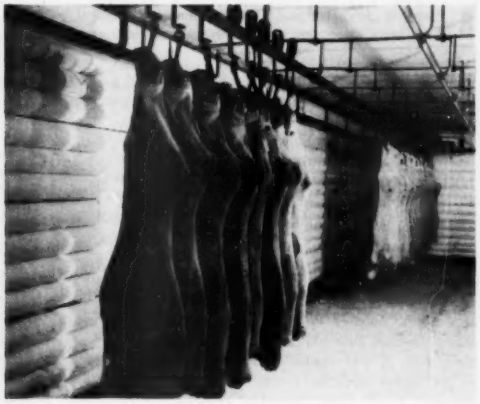


3 New booster compressor is 17¾x12-in. 2-cyl unit with 11x10-in. 2nd-stage machine coupled to motor's far side

4 Brine cooler for street system cools 1500 gpm from 16 to 12 F. Brine pumped through 8 mi of piping under streets



6 Battery of brine pumps in Snyder Ave plant. These pumps supply brine to cold-storage rooms throughout this plant



7 One of the wholesale meat markets served by the 8 mi of brine piping that runs under the streets of Philadelphia

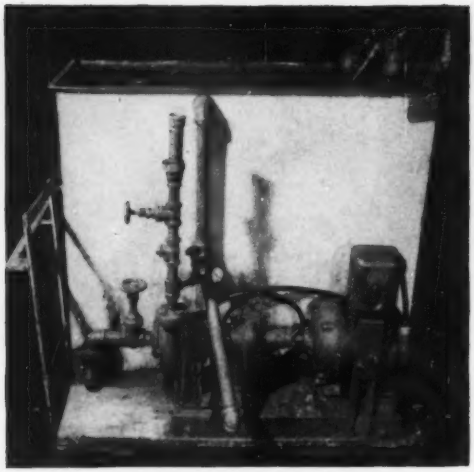
Cooling and Freezing Loads

Brine Pipeline. Wholesale and retail meat, fish, dairy, produce and fruit markets need refrigeration for storage of their products. So do restaurants and similar businesses. Cooling for these purposes can be done in several ways, one of which is by piping brine from a central refrigerating plant. That's the method used in the section of Philadelphia along the Delaware River waterfront.

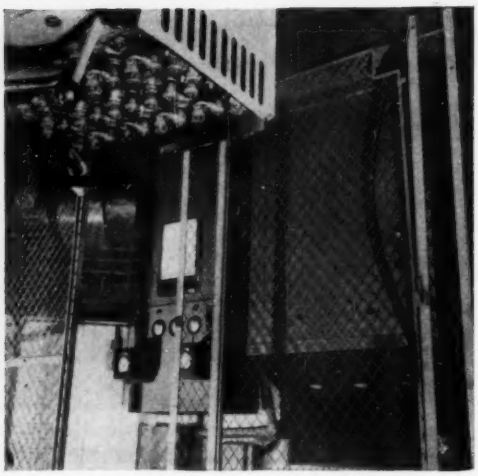
Map, Fig. 1, shows eight miles of pipeline that runs under Delaware Ave and branches off to various intersecting streets. Several 200-ton-capacity brine coolers in the Delaware Ave and Spruce St plant and in the Callowhill St plant supply the pipeline. Brine leaves the cooler at 12 F and returns at 16 F, 3000 gpm being pumped through supply and return pipes under the streets. Brine pressure leaving cooler is 35 psi. Two 8-in. pipes run side by side with branches to and from the various stores and markets served. Pipes are approximately 4 ft underground and are insulated with 3 in. of cork and have valves accessible from manholes spaced at about 250-ft intervals. A spare 200-ton brine cooler stands by main unit, Fig. 4. Typical meat market interior served by pipeline is shown in Fig. 7. Service to these markets is on a 24-hr 7-days-a-week basis.

Cold-Storage Plants. The firm operates three cold-storage warehouses. Sketches, Fig. 1, show Delaware Ave plant and Snyder Ave plant. A third plant is located on Callowhill St.

Refrigeration equipment at Delaware Ave plant serves part of the brine



8 Portable defroster built by company's personnel to make frost removal easier and faster. Unit also removes sludge



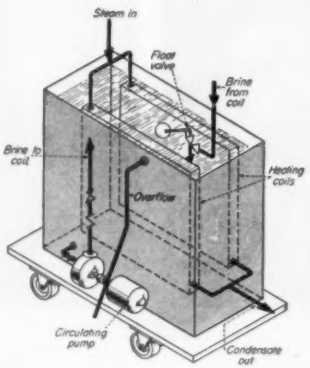
9 Edison storage battery ready for charging by motor-generator set. Batteries receive nightly charge after use

pipeline and all cold-storage space in the three buildings comprising this plant. Total storage space is about 1¾ million cu ft. There are about 75 rooms in the three buildings. Temperatures in these rooms are in the 0 to –10 F range for freezing and 31 to 45 F for cooling.

Two Worthington compressors, one 200-ton and one 150-ton; one 175-ton Ingersoll-Rand compressor; one 200-ton Frick booster compressor are the units used in this plant. Frick booster unit, Fig. 3, was installed in 1950 and is the latest addition to the plant. Increased loads have required periodic upping of capacity. Operating economy dictated choice of a booster compressor. All compressors are ammonia units.

At the Snyder Ave plant, which has about 1½ million cu ft of storage space, three 100-ton Ingersoll-Rand ammonia compressors are installed, Fig. 5. Callowhill St, with about ¾ million cu ft of space, has three compressors, too, one 150-ton De La Vergne, one 200-ton and one 250-ton Worthington. These, like the others, use ammonia refrigerant. All compressors are 2-stage.

Operating Procedures. Brine, pumped through coolers, supplies needed low temperatures in various freezing and cooling rooms in the plants. There are two brine systems, one for freezer service and one for cooler and pipeline service. Generally speaking, freezer brine leaves the coolers at –16 F and returns at –13 F, while cooler brine leaves at 12 F and returns at 16 F. Frosting of coils operated at these temperatures sometimes becomes a problem and as no equipment was included in the original installation, frost-removal problems were solved by constructing defroster shown in Fig. 8 and 10. It works like this.



10 Diagram shows details of defroster, Fig. 8. See text for description

Brine risers and returns run vertically through buildings close to freezing and cooling rooms. Horizontal branches supply coils in individual rooms. Defrosting risers and returns also run vertically alongside the main brine supply lines and are connected to room coils. When frost thickness becomes excessive, the main supply lines are valved off from brine risers and defroster valves opened. Brine in coils drains to the defroster tank, which is controlled by a float valve to prevent possibility of overflowing. In the defroster, brine is heated by two radiator coils supplied with steam from the building main.

A small centrifugal pump mounted on side of defroster tank circulates brine through coils. Direction of circulation may be either from top to bottom or the reverse, depending on whether it it is desired to remove sludge from the coils. Brine is heated to about 60 F, at which temperature the frost "rots" and can be knocked off with a wooden paddle. The frost falls to floor in form of light snow and is immediately removed from room. Where possible, box trucks are placed under the coils and the snow falls into the boxes and is removed without shoveling. Heating-coil discharge is trapped to condensate return header.

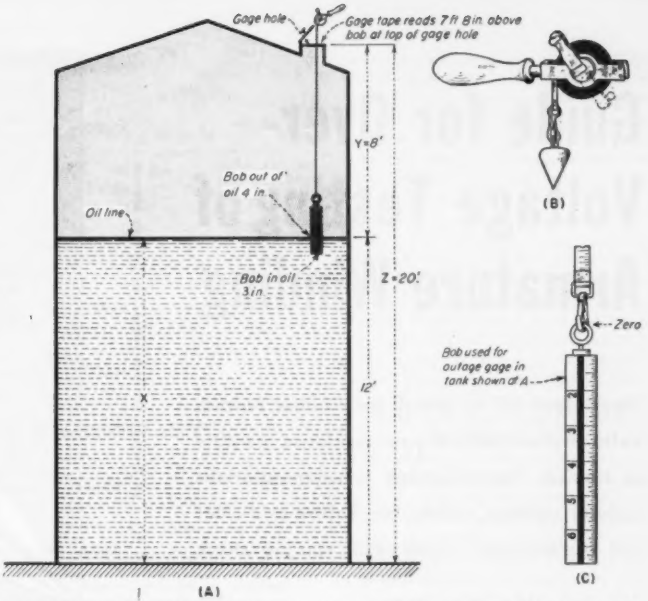
In 1944, nine standard 16-point Leeds & Northrup Micromax recorders were installed, Fig. 2. These give a total of 144 temperature-record points, which are distributed in about 75 rooms throughout the three buildings of the Delaware Ave plant. One to three are used per room. In addition there are also thermohms on the six brine coolers, recording brine temperature at entrance and exit. Lead-wire conduits were installed so they would not interfere with routine maintenance and cleaning of cold-storage rooms. Cost of instruments and their installation was about $20,000. Expense was justified by reduction in personnel needed for obtaining temperature readings.

Close cooperation between the three

(*Continued on page* 176)

Take Mess Out of Oil Tank Gaging

Burton W Wheeler, Rockland, Mass., has thought out fuel-oil tank gaging and comes up with a method that can be a help in power plants with vertical above-ground tanks



VERTICAL FUEL-OIL TANK is easily and quickly gaged with "outage" bob shown at C. This type bob avoids mess of cleaning oil from long tape, gives accurate results

► YOU CAN GAGE fuel-oil tanks by the method POWER described in June '50, p 128, or you can use an outage gage as we do in our plant. Outage method is simple and avoids mess of cleaning oil-covered tapes. Here's how it works.

Oil Tanks. Storage tanks are designed to hold a certain amount of liquid and, of course, tank height remains fixed. Usually these tanks are strapped, that is, calibrated, and tables made giving number of barrels or gallons for various heights of oil. Slight irregularities in tank may cause these readings to be out a little. For instance, number of gallons in 2 in. of height might not be exactly double that in 1 in.

Suppose, as in sketch, we have a certain height, *X*, of oil in the tank and we wish to know the amount. We can drop bob *B* into tank until it hits bottom. We then pull tape up and note measurement at oil line, which gives depth of oil. This is simple but you have to wipe off tape before measuring another tank. It's a messy job, especially in cold weather.

When taking an outage gage, tape and ruled bob shown at *C* are used. Bonded gagers use this type in their work. To take a reading of tank contents, ruled bob is lowered until it is seen to just touch oil. Bob is lowered until tape reads an even number of inches at a mark at top of gage hole, and reading noted. Distance from end of tape down to oil mark on bob is added to measurement on tape at gage hole to obtain our outage gage.

Assume our first measurement at gage hole is 7 ft 8 in., and distance from tape end to bob oil line is 4 in. Adding these we find 8 ft of oil out of tank. This is our outage gage. With a height, *Z*, of 20 ft, height of oil in tank is 20 − 8 = 12 ft. We haven't used complicated math, and all we need do after pulling tape from tank is wipe off small amount of oil on end of bob. We're soon ready to gage next tank without messy job of cleaning entire tape. It's easy to see how clean the gaging job can be.

Correction Factors. No matter what type measurement we take with a tape and bob we've done only half the work to find exact amount of oil in tank. Oil expands and contracts as its temperature rises and falls. The Bureau of Standards has prepared factors for temperature correction based on 60 F. For accurate measurement of amount of oil in tank it is necessary to take oil temperature and correct the volume at observed temperature to that at 60 F.

The table lists a few correction factors from a handbook compiled by E W Saybolt & Co, petroleum inspectors. You use them like this.

If you take a measurement at an oil temperature of 128 F and find you have 238.2 bbl in tank, then quantity based on 60 F is 238.2 (0.9765) = 232.6 bbl. So you can see that correction factors are mighty important when you're gaging a number of tanks. Experienced gagers can read a tape to the nearest ⅛ in., and at our plant we demand accuracy of this order. These correction factors should be used whenever gaging fuel-oil tanks.

Note that dimension *Z* in the sketch is greater than actual cylindrical height. But this doesn't affect accuracy of readings because, for outage gages, measurements are always taken from top of gage hole. Tanks are never filled to top since room must be left for expansion of oil. Tanks gaged by bonded gagers have a mark on flange of gage hole so all subsequent measurement may be taken from the same point.

TEMPERATURE CORRECTION FACTORS FOR FUEL OIL

Group O: 0 to 14.9 deg API at 60 F

t*	m**	t*	m**
125	0.9775	150	0.9691
126	.9772	151	.9687
127	.9768	152	.9684
128	.9765	153	.9680
129	.9762	154	.9677
130	.9758	155	.9674
175	.9606	178	.9596
176	.9603	179	.9593
177	.9600	180	.9590

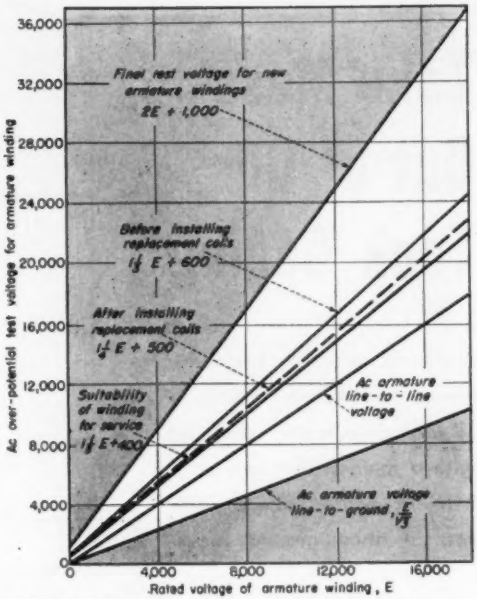
*Oil temperature, F

**Correction factor for reducing oil volumes to basis of 60 F

Guide for Over-Voltage Testing of Armature Winding

Steer clear of ac proof test—twice normal voltage plus 1000—if your machines are now in service. The following recommendations include voltage values for before-and-after coil replacement along with routine check

By R W Wieseman
General Electric Co



AC TEST VALUES outlined above should be maintained for one minute. For dc test, use about 1½ times the ac rms test values

► FOR MANY YEARS, an over-potential test, applied to armature windings in service, has been a controversial question. The accepted over-potential proof test for *new armature windings* for all types above 50 v has been twice normal voltage plus 1000 v sustained for one minute. However, the final determination of proper test voltage is not quite as simple after the machine has been in service for any length of time.

Is is generally agreed that a conservative over-potential test is in order, after inspection and cleaning, to determine whether a winding is in suitable shape for continued service. And, as a purely practical note, by making these tests at the beginning of a planned station overhaul period, time will be available to replace any defective coils that show up without loss of service time.

Insulation Testing. It is interesting to draw a homespun comparison between transmission-line insulators and armature windings. When the former are tested, they are tested individually and faulty insulators are readily detected. But when an armature winding is tested, from 30 to 600 coils or bars are tested in multiple. Since individual testing of armature coils is not practical, any kind of a single-reading qualitative test on the entire winding cannot give a good picture of the insulation condition of machine's individual components.

A high value of insulation resistance, usually measured with a megohmmeter is usually indicative of clean, dry insulation. But in itself it is not proof that the insulation is free from mechanical weakness or that it has sufficient voltage strength. An over-potential test, however, indicates that at the time the test was made, but not necessarily thereafter, the winding has a certain voltage strength. And in the last analysis, an over-potential test is the only test that will indicate whether a winding has sufficient voltage strength for service.

Recommended Procedure. Before an over-potential test is applied, windings should be inspected, and, if necessary, cleaned and dried. Nothing can replace a thorough visual inspection of the machine winding. The aim here is to detect the presence of foreign objects or possible mechanical damage before an over-potential test is made.

Remember that a low-insulation resistance, resulting generally from surface moisture, does not necessarily mean that the insulation is unsuited for operation. This is especially true if the insulation resistance is comparable to that obtained during a recent periodic check. Although in this particular case the machine may be suitable for service, it may not be advisable to apply an over-potential test until the winding is dried and the insulation resistance brought up to normal. In many cases, the increased winding temperature resulting from normal operation will drive off moisture from the winding.

Test Data. Remember that machine windings in service are subjected to temporary voltages greater than normal. These are often caused by load variations, speed changes and surge voltages. Hence, it goes without saying that the voltage of an over-potential test should be somewhat greater than the rated line-to-line voltage E. *Hence, to verify that an armature winding is in good condition for continued service, experience indicates that the ac over-potential test voltage should be about two-thirds the regular ac proof test for a new winding. Since the accepted proof test for new equipment is (2E + 1000 v for 1 min) the resulting approximate formula is (1 1/3 E + 600 v).* These ac test data apply to integral, kw, ac and dc armatures above 50 v designed for usual service conditions. For simplicity, let's call this latter formula equation *1*.

On large Class B insulated armature windings some engineers prefer a 10% higher test voltage than that indicated by Equation *1*.

APPROXIMATE CHARGING KVA OF 13.8-KV SYNCHRONOUS-MACHINE ARMATURE WINDINGS

Winding rated kva	Charging kva for entire armature winding at 60 cycles				
	100 rpm	300 rpm	900 rpm	1800 rpm	3600 rpm
2,500	25	17	12	10	8
5,000	40	28	20	16	13
10,000	70	48	34	27	20
25,000	140	100	65	53	40
50,000	230	160	110	90	70
100,000	390	270	190	150	120

TEST VOLTAGES FOR FIELD WINDINGS IN SERVICE

Machine	Ac(rms) test voltage
Synchronous-generator, 125-volt field	1000
Synchronous-generator, 250-volt field	1500
Synchronous-motor and synchronous-converter fields	1500
Dc motor and generator fields	Same as armature winding for corresponding field voltage

TEST VOLTAGES FOR ARMATURE WINDINGS IN SERVICE

Test	Ac(rms) test voltage	Dc test voltage
Before installing replacement coils or bars	1 1/3E+600	2E+1000
After replacement coils or bars are installed	1 1/4E+500	1 7/8E+ 800
Suitability for service	1 1/5E+400	1 3/4E+ 600

Maintenance Procedure. Where an armature winding is to be repaired and some new coils or bars installed, the winding should first be given an initial ac over-potential test as recommended in Equation *1*. The aim here is to locate and remove all weak or defective coils or bars. Then after repairs have been completed, the work should be checked by applying an ac over-potential test of $1\frac{1}{4}$ E + 500 v.

Where an over-potential test is to be occasionally applied, a somewhat reduced voltage is recommended. Hence, when you wish to check the voltage strength of an armature winding in service the ac test voltage should be in the order of 1 1/5 E + 400 v. These three recommended voltages are illustrated in the above series of curves.

Keep in mind that the recommended test voltages are the voltages to ground. And, of course, all over-potential tests should be applied to the winding for one full minute. When a service over-potential test is to be made, the winding temperature should not be below room temperature, and preferably not above 40 C.

Incidentally, the ac test has been used extensively at power frequencies. Basic thinking here is that the induced voltage in both ac and dc armature windings is alternating, and hence it is somewhat natural to test windings with an alternating voltage.

Test voltage should be relatively free from harmonics. And a sphere gap should not be used in the winding circuit as it may produce harmful surge voltages if an arc-over occurs.

Remember, the 60-cycle charging kva for service tests of large armatures may be as much as 400 kva if the entire winding is to be tested. Hence, considerable equipment is required to make the proper tests on large units.

Dc Test. So far, the test data given apply to ac. Nevertheless, dc is used in cable testing and may also be used to test rotating machine windings. Dc-testing equipment furnishes only the resistance-leakage current. On the other hand, ac equipment must furnish a large capacitance current. Consequently, for large machines dc-testing equipment is much smaller and lower in cost than that for the ac test.

After a dc test has been made, it is necessary to connect the winding terminals to ground for a period of time, depending on atmospheric conditions, to completely discharge the winding. Large Class B insulated windings may retain a considerable electrostatic charge on a dry day for several hours. Therefore, unless the winding has been fully discharged, anyone coming in close contact soon after testing may be fatally injured. The repeated applications of dc with reverse polarity may produce severe insulation voltage gradient. Avoid reverse-polarity voltage tests unless the winding has been completely discharged between each test. Likewise, it is not recommended to use a reverse-polarity dc immediately after a dc over-potential test has been made. This procedure has often been erroneously adopted to reduce quickly the winding's electrostatic charge.

Both ac and dc over-potential tests produce somewhat different dielectric conditions in the winding. The ac test produces a dielectric loss in the insulation and may produce some corona. The dc test produces a different type corona and increases creepage stress. Potential distribution of the winding's end portion depends on resistance for the dc test. However, in the ac case it depends mostly on capacitance. Therefore, in the winding end portion, at small distances from the magnetic core, the dc test will stress the insulation to a greater degree than will the ac test. But, the ac test is preferable for machine windings since it more closely represents actual service conditions.

To puncture various types of undamaged insulation requires a dc voltage of about 1.5 to three times the rms ac voltage. But, this ratio does not apply to the voltage strength of various creepage surfaces of rotating machines in service. Thus, the conservative dc test voltage will be slightly above 1.41 times the ac rms test voltage.

Keep in mind that frequency of over-potential testing depends on service conditions. Some operating engineers find it best to apply a maintenance over-potential test every one or two years to coincide with the over-hauling program.

EDITOR'S NOTE: *Discussion on a practical approach to insulation-resistance measurements may be found on pp 116 and 117 in June 1950,* POWER.

By EDGAR J KATES
Consulting Engineer, New York, N. Y.

How to Choose Your Cooling System

► HERE IS THE SECOND HALF of your "dictionary" of cooling-system layouts and controls. This group covers more complex hookups, including those involving heat recovery.

For simplicity, and to conserve space, diagrams shown do not cover all possible modifications and combinations, particularly for heat-recovery hookups. It is possible, for example, to use jacket heat to warm air for space heating and to install an exhaust-gas boiler to make steam for process. Each of these ideas is diagrammed separately; combining them in suitable fashion will do the double job outlined.

Bear in mind also that the diagrams cover the most likely arrangements and needs. They may be modified to suit special requirements or peculiar local conditions. Select the diagram nearest to your requirements as a starter, you'll then find that modifications can be made relatively easily.

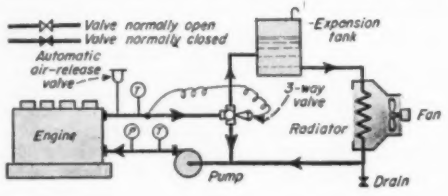
One common form of heat recovery is not diagrammed at all—enclosing the exhaust silencer in a housing through which air is circulated and warmed for building heating. This isn't included because it doesn't concern the cooling-water system nor does it involve any engine controls.

More on Remote Thermometers

In discussing remote-reading liquid-filled thermometers, the third article of this series (Oct, p 93) stated that: (1) Temperature changes along capillary tubes introduce errors that must be compensated if tube lengths exceed 50 ft and (2) for this and other reasons, vapor-pressure thermometers are generally preferred for long runs, say of 200 ft. or more.

J W Schwarz of Taylor Instrument Cos calls our attention to an ingenious type of self-compensating capillary tubing used by his company with mercury-filled remote-reading dial and recording thermometers. A special alloy filler wire extends throughout the bore of the tubing, with the mercury in the annular space between filler wire and tubing. Diameter of wiring and bore of tubing are held to close dimensional limits. Coefficient of expansion of filler wire is so related to that of tubing and mercury that there is no change of volume when temperature changes at any place along the tubing.

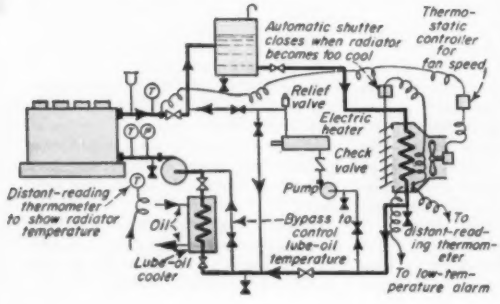
10 CLOSED SYSTEM WITH WATER-TO-AIR RADIATOR



FEATURES: Jacket-water circuit is closed; 3-way thermostatic bypass valve controls engine temperature. A variable-speed fan may also be used to control engine temperature.

PROS and CONS: Virtually no makeup is needed, so scale and deposit problems in jackets are unlikely. Precautions are needed to prevent radiator freezing in cold climates (see No. 11).

11 CLOSED SYSTEM WITH WATER-TO-AIR RADIATOR, FOR COLD CLIMATES



FEATURES: Varying fan speed controls engine-jacket temperature. To prevent freezeups, all water passes through radiator. Shutters protect radiator when engine is stopped. During engine shutdowns in freezing weather, electric heater and auxiliary pump circulate warm water through radiator, and through engine also if desired. (Valve action for electric heater as in Fig. 13, p 93, Nov.) Insulation on outdoor piping reduces heating required. Distant-reading thermometer tells operator when electric heater should be started. Low-temperature alarm warns if thermometer isn't heeded.

Bypass brings lube oil up to operating temperature quickly for cold-weather starting.

PROS and CONS: Fan power consumption is kept to a minimum. Engine temperature is controlled automatically. Radiator and piping are protected from freezing. Engine jackets can be warmed before starting.

Consult this unique dictionary of cooling-system hookups and controls, started in last month's article. Find the layout or combination that comes closest to meeting your needs. Then it's easy to modify basic features diagrammed here to fit your particular conditions and give you a topnotch cooling system

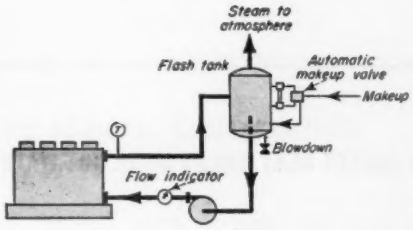
12 HIGH-TEMPERATURE SYSTEM ("VAPOR PHASE"): STEAM WASTED

FEATURES: Jacket heat converted to steam in flash tank. Temperature in engine jackets held constant regardless of load, without mechanical controls. Water flow rate of 0.5 gal per min per bhp prevents steam pockets. Flow indicator shows circulation.

PROS and CONS: High and relatively uniform jacket temperature reduces sludge formation, cylinder wear and corrosion, particularly with fuels containing hydrogen-sulfide. May also reduce fuel consumption. (For analysis of high-temperature cooling, see *Power*, Aug 1941, pp 545-7.)

Makeup needed runs less than 0.5 gal per bhphr. Makeup must be pure, otherwise frequent blowdown is needed to avoid scale and sediment deposits.

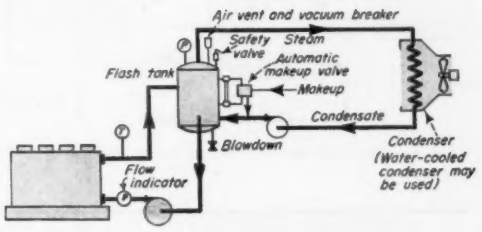
High temperature increases heat radiation from engine. Circulating pump and engine-water passages must be checked to see if they are large enough.



13 HIGH-TEMPERATURE SYSTEM ("VAPOR PHASE"): STEAM CONDENSED AND RETURNED

FEATURES: Essentially same as No 12. Steam is condensed in an air-cooled condenser or radiator, or in a watercooled condenser. Heated air from radiator, or condensing water, may be recovered; see later diagrams.

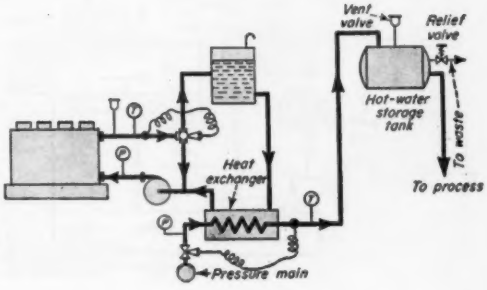
PROS and CONS: See No. 12. Makeup is reduced to a minimum, thus avoiding scale and sediment problems. Condenser is small compared with a cooling tower.



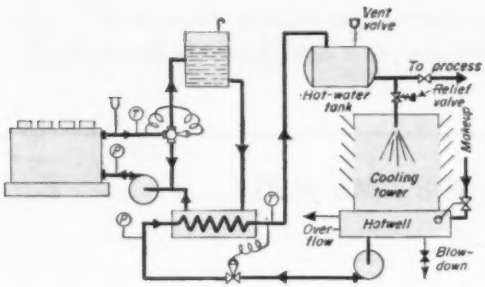
14 HEAT RECOVERY: JACKET HEAT MORE THAN PROCESS DEMAND, EXCESS WATER WASTED

FEATURES: Process water taken from pressure main (or any plant pressure source of suitable purity). Temperature of water to process is automatically controlled. Engine-jacket system is closed, with bypass control. Hot-water storage tank helps to balance process demand and heat supply.

PROS and CONS: Constant temperature of water to process while engine runs. Flow rate of hot water to process varies with engine load, however. Use a supplementary heater if process demand continues while engine is shut down. Engine is assured of adequate cooling regardless of process heat demand.



15 JACKET HEAT MAKES MORE HOT WATER THAN PROCESS NEEDS, EXCESS WATER RECOOLED



FEATURES: Fresh process water system through makeup line into cooling-tower hotwell. Thermostatic valve reduces flow of process water when engine load is light, to keep temperature constant. Pressure-relief valve delivers surplus heated water to cooling tower. Hot-water storage tank used to balance process demand with heat supply.

Engine-jacket system is closed, with bypass control.

PROS and CONS: No loss of water except that used in process. Temperature of water to process stays constant while engine runs. Flow rate of hot water to process varies with engine load, however. Engine is adequately cooled regardless of process heat demand.

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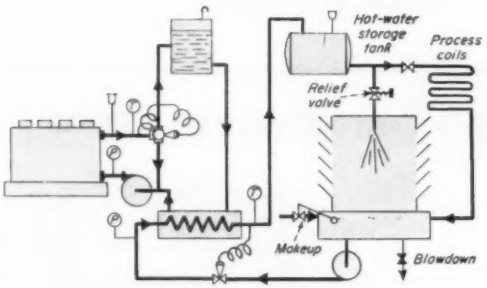
16 JACKET HEAT MAKES MORE HOT WATER THAN PROCESS NEEDS, ALL RAW WATER REUSED



FEATURES: Thermostatic valve reduces flow of process water when engine load is light, to keep temperature constant. Spent process water is returned to the system. Surplus hot water is recooled in cooling tower. Engine jacket system is fully closed with bypass control.

PROS and CONS: No waste of water. Temperature of water to process stays constant while engine runs. Flow rate of hot water varies with engine load, however. Use a supplementary heater if process continues when engine is shut down. Engine is assured of adequate cooling regardless of process heat demand.

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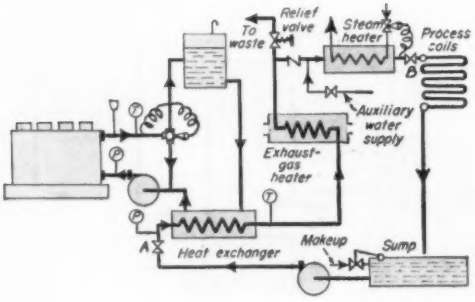
17 ENGINE HEAT MAKES LESS HOT WATER THAN PROCESS NEEDS, AUXILIARY HEATER USED



FEATURES: All available engine heat, including exhaust, is recovered in water to process. Auxiliary heater (steam coils or an automatic gas- or oil-fired heater) maintains constant temperature of water to process, regardless of engine load.

In normal operation, valve *A* is wide open and valve *B* adjusts water flow to process. When process demand stops while engine is running, valve *A* is adjusted to cool engine at maximum load and waste least water. When process goes on while engine is stopped, auxiliary supply feeds water direct to heater. This permits shutdown of circulating pump.

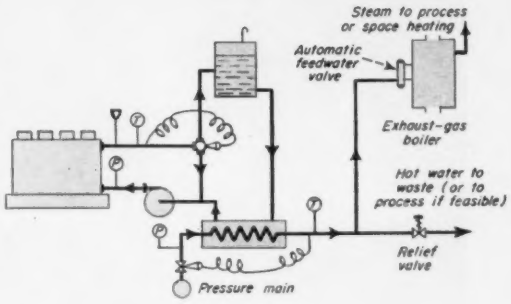
PROS and CONS: Water is wasted only when process demand stops. Process gets all water needs at constant temperature. Engine is adequately cooled regardless of process heat demand.

18 EXHAUST HEAT MAKES STEAM; JACKET HEAT RAISES FEEDWATER TEMPERATURE

FEATURES: Thermostatic valve supplies feedwater at maximum safe temperature regardless of engine load. Closed system and bypass control on engine jacket circuit.

PROS and CONS: Boiler feedwater is as hot as possible. Large temperature rise holds waste of raw water to a minimum.

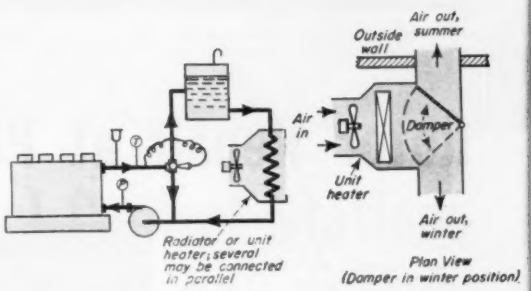
NOTE: Most of raw water and its heat goes to waste because steaming rate (and rate of feed) is limited by heat available in exhaust. Thus feedwater cannot absorb all jacket heat. If feasible, surplus hot water should be used for process heating as in No. 14, 15 and 16.


Steam to process or space heating
Automatic feedwater valve
Exhaust-gas boiler
Hot water to waste (or to process if feasible)
Relief valve
Pressure main

19 JACKET WATER WARMS AIR FOR SPACE HEATING; SEASONAL DAMPER CONTROL

FEATURES: A conventional radiator or ordinary unit heaters may be used. Whether one heater is used, or several are connected in parallel, depends on area to be heated and heat-distribution problems. Engine-jacket system is closed, with bypass control of temperature.

PROS and CONS: Building is heated in winter, ventilated in summer. Constant high temperature of water off engine reduces size of radiator needed. Some form of supplementary space heater should be installed if engine is shut down at times when building heat is needed.



20 HIGH-TEMPERATURE COOLING SYSTEM: STEAM UTILIZED, CONDENSATE RETURNED

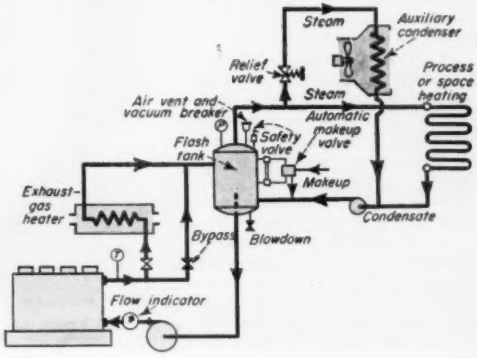
FEATURES: Jacket and exhaust heat converted to steam in flash tank. Jacket temperature stays constant regardless of load, without mechanical controls. Flow rate of 0.5 gal per min per bhp prevents steam pockets. Flow indicator shows circulation.

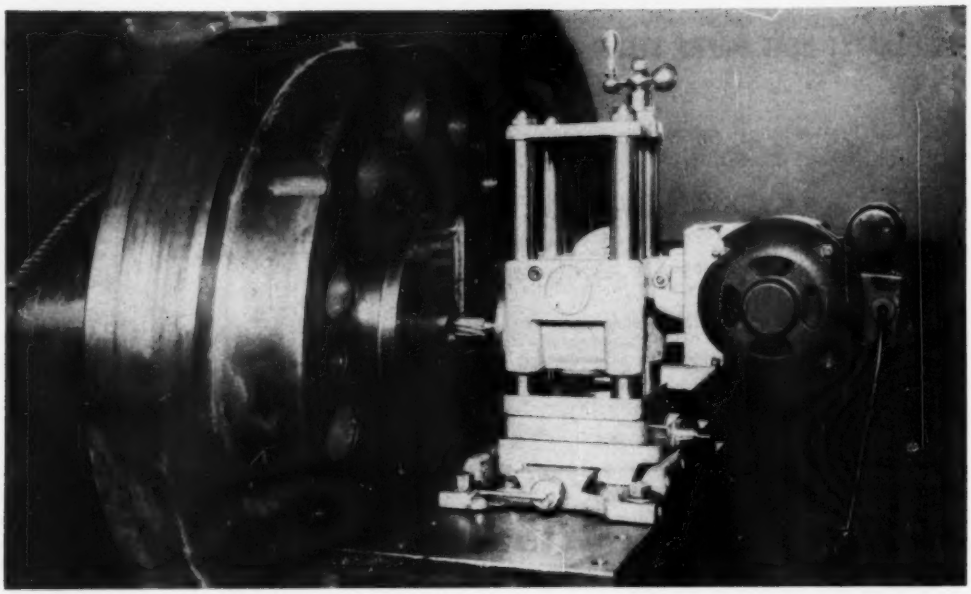
Auxiliary condenser removes heat when process demand is low; fan can be started automatically by pressure switch. Exhaust gas heater can be cut out (if built to run dry) to cut load on auxiliary condenser when process demand is low.

PROS and CONS: Maximum recovery of engine heat. High and relatively uniform jacket temperature reduces sludge formation, cylinder wear and corrosion, particularly with fuels containing hydrogen sulfide. May reduce fuel consumption.

Practically no makeup required, hence no danger of scale or sediment troubles. Auxiliary boiler is needed if process must be supplied when engine is stopped. Auxiliary condenser is small compared with a cooling tower.

High temperature increases heat radiation from engine. Circulating pump and engine water passages must be checked to see if they are large enough.





MILL AND FEED TABLE. The mill is removing ¼ in. from 13-in. diameter face of turbine coupling rabbet in one pass. The material being milled is a vanadium-steel forging. Four settings were needed to finish job because travel was limited

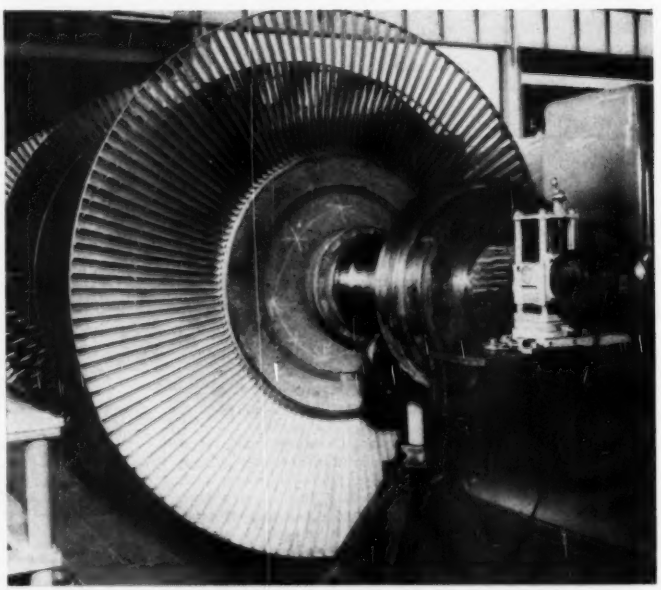
Rotor Repair at Plant Saves Shipping

► REPAIRS ON A TURBINE, at the plant of one of the leading public utility companies, required removing ¼ in. of length from the rabbet of a coupling. Shaft and coupling were vanadium-steel forging. Complete rotor had a diameter of 7½ ft and weighed several tons. The piece was too heavy and too large to be machined in any local shop.

To return the complete rotor to the manufacturer would have required shutting down the turbine for at least two weeks. Handling, shipping, protecting for shipment, and the machining costs at the manufacturer's plant were estimated at about $2000.

Additional advantage of doing work in plant was avoidance of danger of shipping damage. Savings in labor and transportation were over twice mill cost, downtime 20% original estimate.

The machining was done without removing the rotor from the power-generating station. Bolted to coupling face was an angle bracket, and on it a *Versa-Mil* with its feed table was mounted. The end mill removed the full ¼-in. depth of cut in one pass. But since the feed table and vertical lead screw gave travel limited to 9x7 in., it took four settings to complete job.

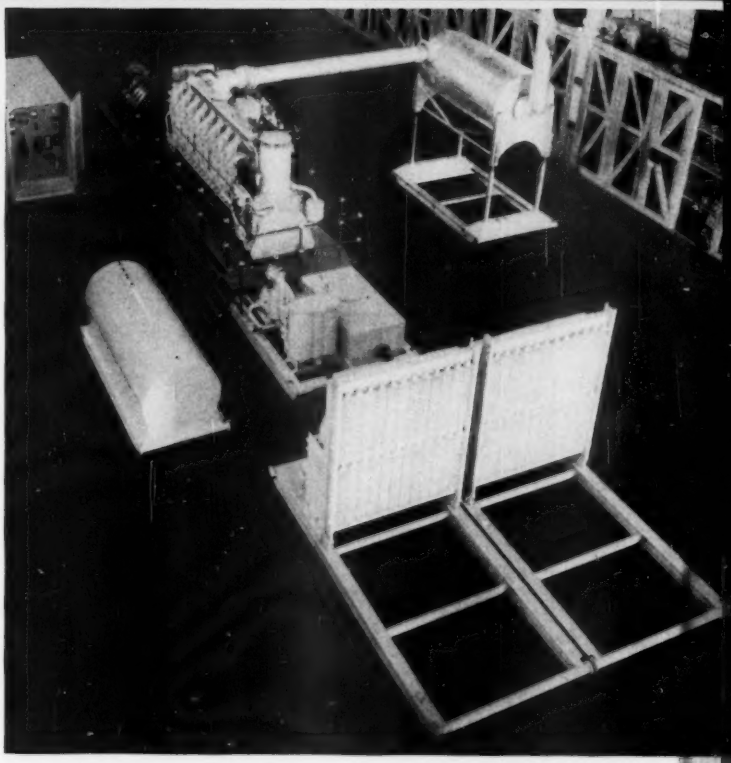


ROTOR COUPLING during machining looked like this. It's easy to see how money and time were saved by doing this job right in the turbine room, using compact end mill

When Mexico's Comision Federal de Electricidad required power plants for emergency service, they specified portable units that could be:

1. **Assembled immediately on arrival with minimum labor and no foundations or mats**
2. **Transported either by truck or narrow-gage railroad, within limits of height, width and weight**
3. **Depended on for heavy-duty continuous service with fuel and lube-oil economies equal to stationary plants**

From these specs, American engineers developed . . .



...Skid-Based Diesel Central Stations

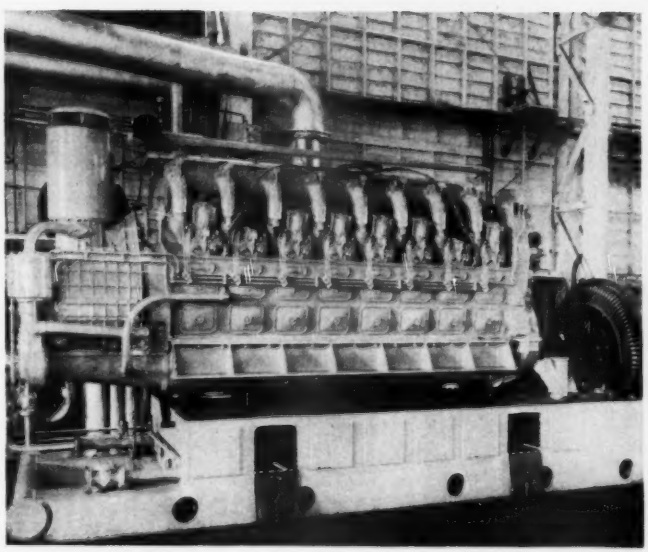
► To meet the needs of Mexico's government power authority, A G Schoonmaker Co, Inc, designed and manufactured large portable generating plants employing standard components combined in ingenious fashion. Some of these sets have seen three years' service; units pictured are part of a repeat order to meet rapidly growing demand.

Photo above shows how plant is divided into unit assemblies; following pictures show how each assembly is designed for maximum compactness and portability. V-type 1600-hp diesel mounts on a common steel sub-base with generator. A special flexible coupling makes it possible to disconnect engine from generator without disturbing alignment. A long generator shaft permits shifting stator in field.

A skid-mounted 1000-gal fuel tank takes care of one unit about 24 hr. If oil arrives in drums, it can be transferred to the fuel tank by using compressed air from starting-air assembly.

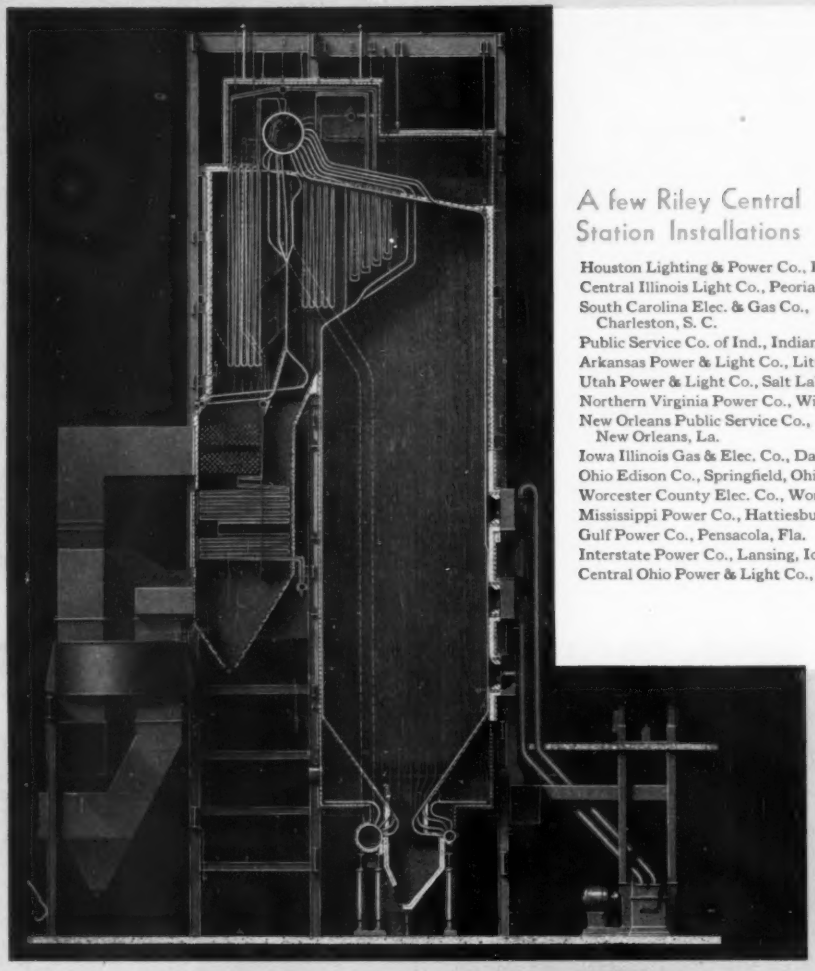
Electrical equipment includes a 50-kva 3-phase house transformer, lighting transformer and fused switches.

(*Continued on page* 106)



BUILT-IN SCREW JACKS raise engine for insertion of wooden shipping skids, when transportation limits (weight, height, etc) require removing it from the main base

Why Do So Many Companies Repeatedly



UTAH POWER & LIGHT CO.
Jordan Station, Salt Lake City, Utah

620,000 lbs./hr.—1500 psig—955°F.
Bechtel Corp., Consulting Engineers

A few Riley Central Station Installations

Houston Lighting & Power Co., Houston, Tex.
Central Illinois Light Co., Peoria, Ill.
South Carolina Elec. & Gas Co., Charleston, S. C.
Public Service Co. of Ind., Indianapolis, Ind.
Arkansas Power & Light Co., Little Rock, Ark.
Utah Power & Light Co., Salt Lake City, Utah
Northern Virginia Power Co., Winchester, Va.
New Orleans Public Service Co., New Orleans, La.
Iowa Illinois Gas & Elec. Co., Davenport, Iowa
Ohio Edison Co., Springfield, Ohio
Worcester County Elec. Co., Worcester, Mass.
Mississippi Power Co., Hattiesburg, Miss.
Gulf Power Co., Pensacola, Fla.
Interstate Power Co., Lansing, Iowa
Central Ohio Power & Light Co., Bluffton, Ohio

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

Order RILEY BOILER UNITS ?

Why do so many companies repeatedly order Riley boiler units?

Large numbers of the countries well-managed leading public utility and industrial companies have, with gratifying regularity, placed repeat orders for more Riley units when installing additional steam generating units. This preference—this refusal to accept something almost as good at a lower price, tells a significant story of the satisfactory performance of Riley steam generating equipment.

Users well know the operating advantages of Riley units—their ability to operate at high capacity over long periods of time, their high sustained efficiency, their negligible maintenance and trouble-free operation. Operating advantages resulting from the many distinctive design characteristics, liberal design, sound engineering and excellent fabrication, and erection of Riley units.

The large number of repeat orders representing more than half of all Riley sales, together with the decided swing to Riley by companies installing Riley units for the first time, have again carried Riley sales to the highest in Riley history. Users have learned

You Can Rely on Riley

A few of the many companies who have repeatedly ordered RILEY BOILER UNITS

CARNEGIE-ILLINOIS STEEL CORPORATION are now installing five more Riley units—9 orders—16 Riley boilers—5,120,000 lbs./hr. capacity.

DOW CHEMICAL COMPANY have just completed the installation of their fourteenth Riley unit and will install four more next year. 10 orders—18 Riley boilers—4,930,000 lbs./hr. capacity.

STANDARD OIL CO. OF CALIF. have placed 13 orders for 21 Riley boilers with a combined capacity of 1,860,000 lbs./hr.

UTAH POWER AND LIGHT CO. are now installing two Riley units and will install two more next year. 4 orders—4 Riley boilers—1,760,000 lbs./hr. capacity.

HOUSTON LIGHTING & POWER COMPANY have ordered nine Riley boilers having a capacity of 4,590,000 lbs./hr.

CARBIDE AND CARBON CHEMICAL COMPANY are installing three additional Riley boilers, making a total of nine orders, 20 boilers, 2,805,000 lbs./hr. capacity.

ESSO STANDARD OIL COMPANY have just completed the installation of their tenth Riley boiler—7 orders—1,965,000 lbs./hr.

CELANESE CORPORATION OF AMERICA just recently ordered four more Riley units—15 orders—27 boilers—3,130,000 lbs./hr. capacity.

CENTRAL ILLINOIS LIGHT CO. have installed six Riley boilers having a capacity of 2,000,000 lbs./hr.

PUBLIC SERVICE CO. OF INDIANA have placed four orders for seven Riley boilers with a capacity of 2,400,000 lbs./hr.

HUMBLE OIL AND REFINING CO. have installed eight Riley units with a capacity of 1,600,000 lbs./hr.

INTERSTATE POWER COMPANY just placed their fourth order with Riley making 6 Riley boilers with a capacity of 725,000 lbs./hr.

IOWA-ILLINOIS GAS & ELECTRIC CO. have ordered five Riley boilers with a capacity of 1,010,000 lbs./hr.

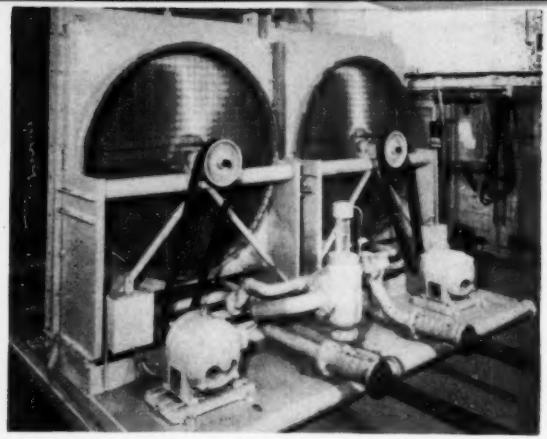
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

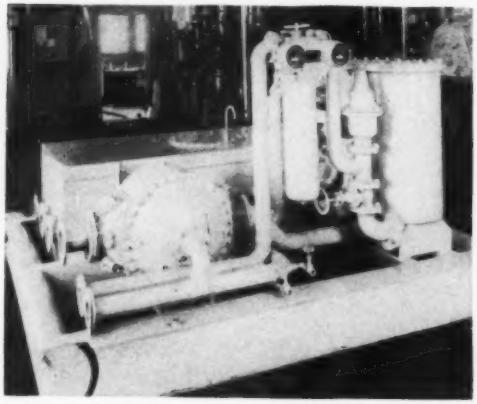
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS

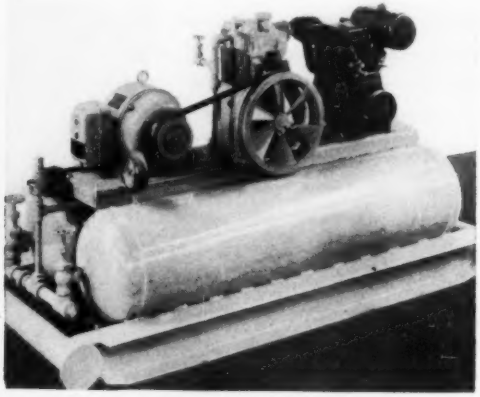
RADIATORS FOLD DOWN on skid mounting by means of pin hinge. This saves space, protects radiators during shipment



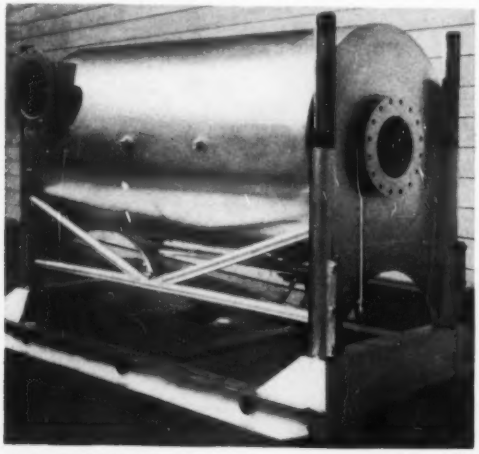
IN OPERATION, radiators stand in front of lube-oil assembly, piped back to engine through it. Note thermostatic control



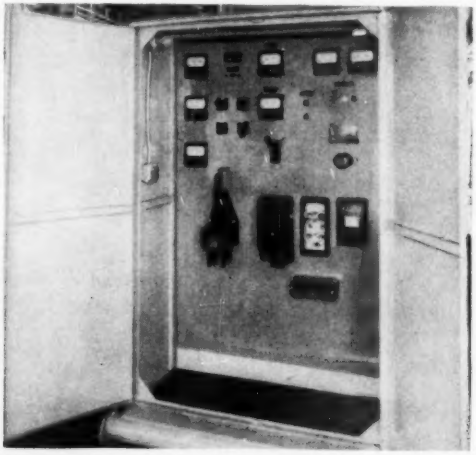
LUBE-OIL ASSEMBLY includes sump, lube-oil filter, strainer and cooler. Special skid shape at left connects to main base



STARTING-AIR COMPRESSOR is air cooled, driven by motor or gasoline engine. Units mount atop two air tanks on skid base



DRY-TYPE MUFFLER is mounted so it can be raised by jacks to operating position, then held by a pin-and-clamp arrangement



SWITCHGEAR CABINET, skid-mounted like rest of units, consists of generator and exciter control, synchronizing panel

America's Road to Victory

. . . Let's Increase Production

This is the time to speak out—now—at the beginning.

Our industrial program for re-armament is getting off on the wrong foot.

The talking and writing about it emphasize the wrong things.

Its headline words are "cuts" and "controls."

Those words make bad propaganda for the cold war.

"Cuts" and "controls" are no words to challenge the imagination and energy of our own people. They won't impress the masters of the Kremlin. And they can only make it appear to the rest of the world that America thinks it can defend the free way of life by abandoning it.

America stands as the world's champion against aggression because America has become the most powerful free nation in the world.

How did we get that way?

Not by putting ceilings on wages; not by rationing or clamping iron-clad government controls all over business and industry.

To be sure, some temporary controls are necessary to channel very scarce materials speedily to use for defense. So, too, are special taxes and credit restrictions needed to combat inflation. But they will be fatal if they blind us to this fact:

We became the strongest nation in the world by out-producing every other nation.

Production—The Final Answer

Next year our government is planning at least a $40 billion military program. Instead of planning only on controls to divert $40 billion of production from the making of civilian goods to the making of military supplies, we should be figuring out also ways to push up total production.

Of course, our industrial plant is running at close to "capacity" now. And our labor force has reached almost full employment. There isn't much slack to be taken up.

Can even the United States add a $40 billion miracle of production on top of what it is already doing?

Our answer is "Yes"—and within two years. It can be done by adding about $6 billion each year to our program of capital investment which now runs about $22 billion a year.

Part of this added production will come from expanding our industries. The steel companies, for example, already have plans to increase their capacity almost ten per cent in the next two years.

But by far the largest part of that $40 billion of added production must come from higher productivity—raising industry's efficiency.

continued on next page

To meet our goals we need to raise our productivity five per cent a year.

Can it be done?

The answer is an emphatic "Yes."

Raise Industry's Productivity

McGraw-Hill's studies of industry's equipment show that there are countless opportunities for improving efficiency. Our manufacturing industries alone need at least $35 billion of new equipment to raise their facilities to first class technical standards.

Here are some of the broad possibilities reported by the trained editors of McGraw-Hill's business magazines:

In many manufacturing plants as much as 40 per cent of workers' time goes into moving materials and parts—shifting things about within the plant between processes and to and from shipping platforms.

FACTORY estimates that improved materials handling equipment and methods might well cut handling costs twenty-five per cent and save annually over 650,000 man-years of unnecessary labor.

Modern machine tools designed since World War II are 40 per cent more productive, on the average, than is old equipment. But AMERICAN MACHINIST surveys show that 95 per cent of industry's machine tools are of designs at least ten years old. Replacing them could raise productivity of the metalworking industries at least ten per cent—enough to absorb a major share of the metalworking industries' part of the defense program as now planned.

In coal mining, latest equipment and methods can raise productivity sharply. The editors of COAL AGE estimate that production of bituminous coal could be raised from seven tons per man-shift to ten within three to five years.

Many new textile production techniques are 50 per cent to 75 per cent more efficient than those in use now. If plants could be fully modernized, and full use made of latest management methods, TEXTILE WORLD estimates that output-per-manhour would rise 20 per cent. *A FOOD INDUSTRIES study indicates that modern equipment plus the best management techniques could raise productivity in food processing at least 20 per cent.*

These are just some of the opportunities that industry can seize and by which the nation can profit.

A Nation-Wide Effort

Of course, industry itself can't do the whole job. Labor, government and all the rest of us must cooperate.

Government's part is to see that its emergency controls are so applied that they will increase productivity and thus make possible an early lifting of such controls.

Labor's part is to help in the development of labor-saving methods and machinery and to welcome their adoption as the only sure way of continuing to advance the American standard of living while maintaining the American free way of life.

For all of us the job is to work constantly for an expanding, ever-stronger America with constantly growing productivity; not a pinched and shackled America cooped up under wage and price ceilings and tied to a ration card.

Challenge to Industry

Here is a sharp challenge to industry to study the best work-methods that are being reported—to use every minute and every dollar it can to replace obsolete equipment.

Here is a sharp challenge to government to do everything within its power to make its control policies and its fiscal policies strengthen the incentives to industrial modernization—to demand sacrifice for a purpose and not for effect.

The job to which such opportunities point will take time—though nothing holds back adoption of some of the simpler improvements in work-methods reported in business magazines all the time.

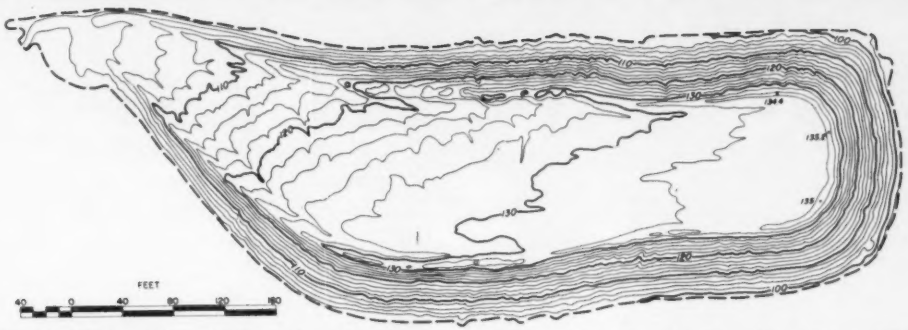
But increasing production is our one best hope that we may be spared the full array of price, wage and production controls now and be freed eventually from all controls.

General Omar Bradley has said that the protection of our national independence calls for "long-range commitments that we are willing to carry out."

A long-range commitment to fight this battle for peace with America's most powerful weapon—industrial productivity—is the surest guarantee of victory for the free world.

Let's make that commitment—now—at the beginning.

McGraw-Hill Publishing Co., Inc.



TWO PHOTOS OF EACH COAL PILE taken from different viewpoints *(sample above)* can be converted to accurate topographic map shown below. Four elevation points and two horizontal points must be precisely located in each area phootgraphed

Air Mapping of Coal Piles Saves Cash

► In 1950, Philadelphia Electric Co took stock of its coal on hand by aerial mapping. This method gave results accurate within 3 to 5% and made the figures available in 10 days from the date of survey. Inventory costs of coal were cut 25% by this procedure.

The 500,000-ton coal stock is stored in 10 different locations. Some stockpiles hold as much as 85,000 tons. Aero Service Corp, of Philadelphia, ran the survey by taking a pair of aerial photos of each site. The photoflights were completed in a few hours. Exact time of making the pictures was noted so stocks could be corrected to any required date. Photos were taken at an altitude of 1200 ft.

Each 9x9-in. picture covered about 75 acres. They were overlapping stereopairs. Inserting these in a stereoplotting machine gives a 3-dimensional view of the terrain, which allows accurate plotting of each contour. Prior to plotting these contours, four known elevation points and two horizontal points must be established on the ground in each picture.

On the topographic map each contour area was measured with a planimeter. With this information the volume of each layer in a coal pile was calculated. Summing up the layers gave the total volume in the pile. For instance, the volume in the pile photographed and mapped above is 2,576,900 cu ft. Maximum pile length is over 700 ft and height is over 35 ft.

To convert volume to tonnage required establishing coal density. This was done on each pile by weighing known volumes of coal taken as samples. Multiplying pile volume by coal density, tons per cu ft, gives total tonnage.

Costs for this work vary according to size of areas to be mapped, location, airport facilities, scheduling and other factors. Even when mapping only a few stockpiles, some saving over conventional methods will be possible. Speed and accuracy are advantages of using aerial inventory methods.

Aerial mapping has been used to find the amount of product removed from open pit mines. An air survey of a stockpile of logs is now in progress. Potential applications of this procedure include the inventorying of large ore stockpiles at plants and mines and also of spoil banks next to mines. It often happens that as prices for minerals increase, the spoil banks are reworked to recover the lower-grade ores. Volume of the spoil bank is one factor determining the amount of ore that is recoverable by further processing.

KODAK PARK, a city-within-a-city, covers about 400 acres and stretches out to 2¼ miles. Interior production areas are vacuumed and scrubbed, quite in keeping with the white surgical garb of many employes. Much work is done in air-conditioned, darkened rooms where a single stray shaft of light, or an oil fog, could render sensitive photographic equipment useless

WITH NEW MACHINE...

1 We learn about a new machine from the company's design engineers, if it is being built within the company. Purchasing engineer supplies the lead if the machine is being built by an outside manufacturer.

2 Study the needs of the particular machine and make recommendations as to lubrication devices, bearings, gears, etc.

3 Field division notifies us when the equipment is ready for installation. Then a lubrication engineer is sent to the scene.

4 Proper lubricant is recommended, lube schedule set up and distributed to the field division and production department involved.

5 Trouble-shooting, follow-up operations, and revision of schedule to meet changes in operating conditions follow as required.

How Planned Lubrication Pays Off

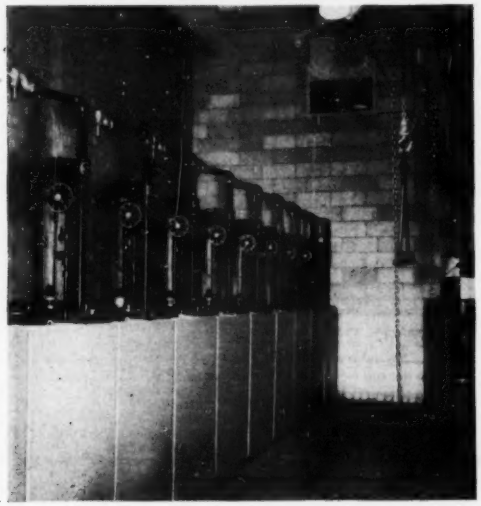
By C L POPE, *Head of Lubrication Section*
Eastman Kodak Company

About the same volume of lubricants is used in this plant today as in 1930, when the lube plan started, even though production zoomed 300%. Application costs reduced, too. That's a sizable item since it's generally five times lube cost

► KODAK'S LUBRICATION PROGRAM was started at Kodak Park in 1930. At that time a survey by our industrial economy department showed we were using nearly 500 types of oils and greases, with each department specifying lubricants for its own use. In many cases, different lubricants were used to do the same job in various parts of the plant. As a result, the lubrication section was established and assigned the primary project of reducing the number of lubricants.

It was not a simple job. Although several large industries were practicing a regular, planned lubrication program at that time, we were "orphans" with little or no industry experience. This was so because much of the equipment used in photographic manufacturing must be designed and constructed under company supervision. We had to

LUBRICATION ENGINEERS confer on troublesome gear. Author C L Pope is flanked by two assistants in Kodak's Lubrication Department. Frequent conferences are in order, running the gauntlet from lubrication system design to maintenance. Each failure in a machine part is carefully analyzed to see if change in lubrication or schedule will stem future troubles



OIL AND GREASE are kept in locked storage room, accessible only to lube men. This precaution generally means proper handling of lubricants. Note firedoor on the vent grille

OUT-OF-THE-WAY bearings piped to convenient point. Here's how grease is applied to grate bearings on a steam boiler. Grease gun being used is fed from reservoir under pressure

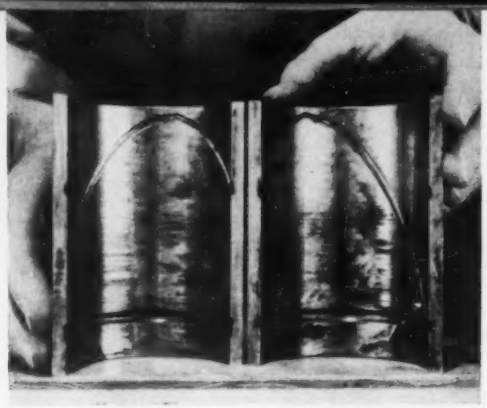
start our lubrication plan from scratch.

Lube Survey. First step in our program was to survey all mechanical equipment in the plant. Aim was to determine the best oil and grease for each need. Next, we simplified to make it easier for the maintenance man and reduce number of lubricants.

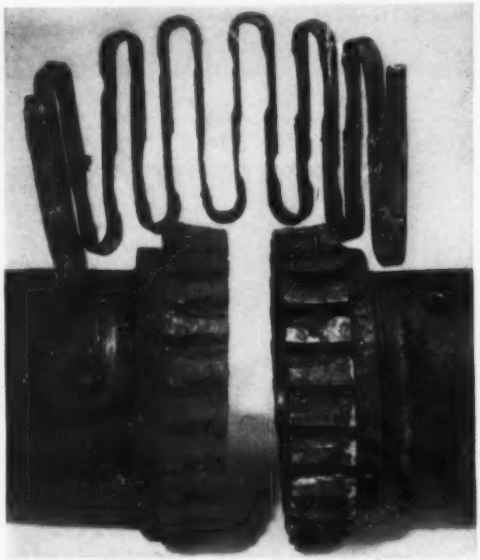
We then established a lube-testing program. Greases were tested for such properties as penetration, melting point, and type of soap. Oils were analyzed for viscosity, flash point, pour point, rusting and oxidation properties, interfacial tension, and acid number. In addition, we had to set up a special fogging test for oils. This is a test peculiar to our industry since some oils will fog photographic film.

By setting up specifications we were able to reduce the number of general lubricants stocked to 15 oils and 4 greases. On top of that there were 25 lubricants required in smaller supply for special purposes. We then supplied the purchasing department with a list of approved brands of lubricants for each of our specifications.

An important step came when we established periodic sampling of lubricants in actual use. Physical testing to determine oil life in gear cases, turbines and other equipment gave us



BEARING FAILURE caused by poor oil grooving at pressure area. Kodak lubrication engineers make liberal use of photography to provide an accurate record of year-to-year changes



COUPLING FAILURE caused by wrong lubricant. Grease used was found to centrifuge into oil and soap. Analyzing coupling operation, then selecting proper lubricant solved problem

RESPONSIBILITIES OF OUR LUBRICATION ENGINEERS

1 Determine which lubricant is needed for each piece of equipment.

2 Write lubrication specifications.

3 Analyze all new lubricants under consideration and periodically test those in service.

4 Specify to laboratory technicians tests to be run on all incoming lubricants. Furnish the stores department with limits for acceptance and rejection.

5 Issue through the material-standard department the principal uses for each lubricant along with definite recommendations for a large variety of specific equipment.

6 Standardize lubrication devices.

7 Interview all oil salesmen, sales engineers and technical men connected with the oil industry, lubrication devices and oil-reclaiming equipment.

8 Make lube surveys of all equipment to specify the lubricant, devices needed, oil changes and necessary maintenance schedules.

9 Issue standard practice and lubrication guidance through the engineering and maintenance divisions.

10 Report back to the purchasing department any lube failures that develop after equipment is in service. Also furnish the purchasing department with lubrication requirements when machines are purchased.

11 Investigate and make reports on all machine failures that may involve lubrication, contamination of product from oilspots, etc.

12 Offer assistance to the design engineering divisions in the selection of lubrication systems, bearings, etc. This holds for our special equipment as well as standard equipment from outside manufacturers.

13 Develop new tests for lubricants where there are no existing approved tests.

14 Keep informed on all developments through contacts with oil refineries, laboratories, ASTM, ASLE, ASME, SAE and AGMA.

enough data to set up schedules for oil changes and preventive maintenance.

Complete lubrication schedule, including location of equipment, parts to be lubricated, method of lubrication, oil or grease to be used, and frequency of lubrication and inspection resulted from our studies. Copies of the schedule were presented to each department and the maintenance man in charge of servicing equipment.

Extent of Plan. Based on experience through past years, we now list general lubrication recommendations in the company's material-standards catalog. Then when a new piece of standard equipment from another manufacturer is installed, maintenance men follow the general catalog recommendation for lubrication. If this doesn't work satisfactorily, one of our engineers is called in to prescribe another lubricant.

Since planned lubrication has been justified we have worked hand-in-hand with our design engineers on new equipment, even at the drawing-board stage. When a new machine is planned, lubrication-section experts are consulted on means of lubrication, choice of bearings, choice of material, choice of gears, method of controlling oil leakage, engineering data on fluid friction, bearing clearances and running position, and running temperature. We also supply lubrication modifications to meet our production requirements on new standard equipment purchased from the manufacturer.

Our lubrication engineers interview equipment engineers regarding lubrication devices and specifications for proposed equipment purchases. We handle no actual purchasing. But we do supply lists of oil specifications, recommend brands of oil and grease, approve bearing and lubricating devices, etc, to the purchasing department. They, in turn, use our recommendations as

TYPICAL LUBRICATION SCHEDULE IN ONE PART OF KODAK PLANT

Machine No.	Equipment	Method of lubrication	Lubricant	Inspect	Remarks
13	**7500 kw—ac unit**				
	Main oiling system	Circulating	1150	Shift	Send 1 pint oil sample to lab monthly
	Governor linkage	Oil can	2005	Shift	
	Governor cam bearing	Grease gun	EK-M	Shift	Clean 1st Sunday each mo, 8-4 shift
	Centrifuge	Splash	1150	Daily	Clean bowl weekly
13	**Stoker**				
	Gear cases	Splash	2007	Shift	Change oil yrly, fireman on duty (FD)
	Turbine gear cases	Splash	2005	Shift	Change oil yearly, FD
	Link-grate hyd drive	Circulating	2005	Shift	Change oil yearly, FD
	Main & conn rod brg	Grease gun	EK-M	8-4 shift	H-p boiler operator
	Link-grate mechanism	Grease gun	EK-M	8-4 shift	H-p boiler operator
	Secondary ram and chain drive	Oil can	1150	8-4 shift	H-p boiler operator on Sunday
	Stoker ash grates	Grease gun	EK-M	8-4 shift	Boiler helper
1	**Air compressor**				
	Crankcases	Splash	1600	Shift	Change oil March 1st and Sept 1st
	Gear box	Splash	2007	Shift	Change oil yearly, FD
	Steam cylinders	Lubricator	2007	Shift	Overhaul lubricators yearly, FD
	Air cylinders	Lubricator	2005	Shift	Overhaul lubricators yearly, FD
	Steam valves and rods	Sight-feed cups	2007	Shift	
	Air rods	Sight-feed cups	2005	Shift	
11 & 12	**Turbine-driven f-d fans**				
	Turbine bearings	Ring oiled	1600	Shift	Change oil yearly, FD
	Reduction gears	Circulating	1600	Shift	Change oil yearly, FD
	Fan bearings	Ring oiled	1600	Shift	Change oil yearly, FD
	Flexible couplings	Bath	Comp 1	Yearly	On yearly overhaul, FD
	Purifier (oil)			6 months	Renew 3/1 & 10/1, FD
	Air dampers	Grease gun	EK-B	6 months	Boiler-room oiler

a basis for their decisions on equipment and stock purchases.

We maintain constant contact with the petroleum divisions of the engineering societies and American Society of Lubrication Engineers. Our men attend meetings of these groups to check innovations and current lubrication practices.

Once our program had been established and was working smoothly, the problem of educating personnel to the importance of lubrication became apparent. Without such education the plan would fail. We had to "sell" lubrication to department supervisors, maintenance men and our engineering groups.

By lectures and photographs we pointed out what effective lubrication accomplishes. The more technical aspects of lubrication engineering were presented to our design engineers.

The accomplishments of our program are many. Today we are using approximately the same volume of lubricants we used in 1930 when the program was initiated, although our production has risen 300%. We find that the *cost of applying lubricants is about five times the cost of the lubricants themselves*—but there is a large saving in maintenance costs. Our lubrication program, we believe, has resulted in at least a 10% reduction in maintenance.

When the lubrication section was established we were assigned to development of specifications for lubricants to be used at Kodak Park. Today the scope of our activities has been greatly expanded (see chart, p 110).

Reduction of maintenance costs and especially of maintenance time has been an important function of the lubrication division. One of the best justifications of its existence, however, is the continual growth in importance and scope of our activities and responsibilities in improving plant lubrication.

POWER PLANT when first built had four 6-runner horizontal-shaft 2000-hp units. Today, 3100-hp vertical-shaft propeller turbine replaces one old unit, the three others are modernized, total plant generating capacity increased to over 13,000 hp

40 Years at Kilbourn Hydro Plant

By **NEWTON A LANDT**, *Generating Sta Mgr, Kilbourn Plant, Wis. Power & Light Co*
and **EDWARD UEHLING**, *Engineer, Hydraulic Dept, Allis-Chalmers Mfg Co*

An old plant with four 6-runner horizontal-shaft units increased capacity 65% while being modernized. Corrected were dam, plant intake, draft tubes, turbine shaft and other troubles. One old unit was replaced, the other three units were redesigned

► ALMOST CONTINUOUS CHANGES and improvements have kept the 40-year-old Kilbourn station, of Wisconsin Power and Light Co, in a high state of efficiency for a hydroelectric power plant of its size. A brief description of the design and operating difficulties that developed and how they were solved may be helpful to others in keeping old plants up to a high standard.

Original Installation. The dam on the Wisconsin River is south of Wisconsin Dells where the river makes a right-angle turn. All preliminary work and construction was under the direction of the late Daniel W Mead, consulting engineer. The concrete dam, extending over a rock-filled timber-crib base, is about 350 ft long by 55 ft maximum height with twelve 25-ft-wide by 6-ft-high spillway gates. Concrete piers form 11 entrance channels without gates between the river and the headrace leading to the powerhouse.

Powerhouse was designed for four main and two small exciter horizontal shaft units in separate flumes. To obtain maximum power and highest speed under the low head of 17 ft, the best current practice then was a number of francis runners mounted in pairs on one shaft.

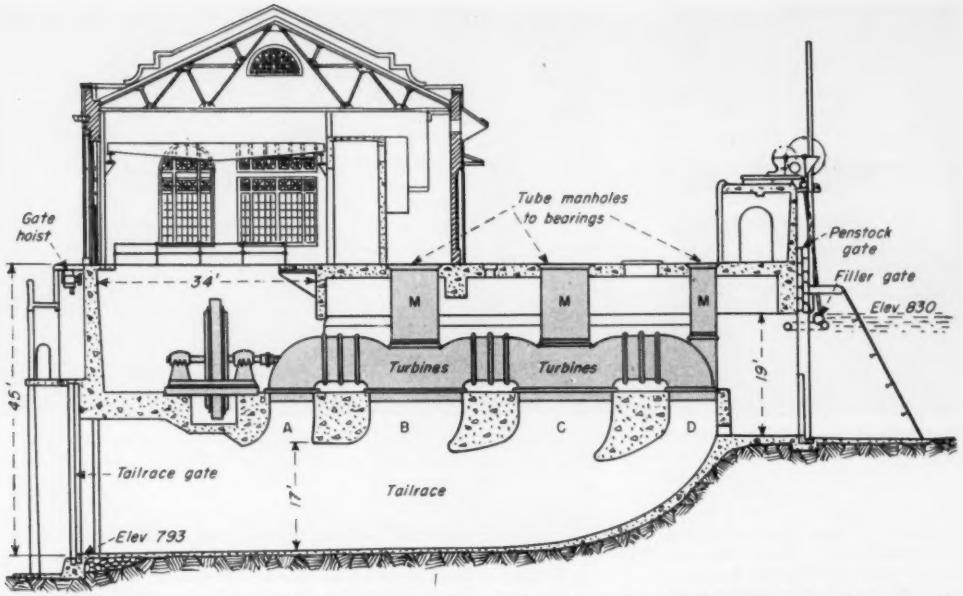
Main units, as put in operation in 1909, each had six runners rated 2000 hp total at 100 rpm, built by Wellman-Seaver-Morgan Co, who have not made waterwheels for many years. Each turbine connected to a General Electric 1500-kw 2300-v 25-cycle generator. The two small units each consisted of twin Jolly-McCormick wheels, designed to develop 250 hp at 200 rpm and coupled to GE 150-kw exciters.

Powerhouse. The drawing is a cross-section showing flume and powerhouse arrangement for a 6-runner unit. Runners, arranged in pairs, had short concrete draft tubes, *A*, *B*, *C* and *D*. Draft tubes *A* and *D* were single discharge, and *B* and *C* double discharge. They were made longer toward the upstream end of the turbine. Turbine bearings in the draft chest were reached from above the flume through manhole tubes. *M*, extending down to each bearing.

Draft-Tube Trouble. Plant went into operation in August 1909, with a full-headwater elevation of 831.42 ft. Only under extreme floods does headwater reach higher levels. Tailwater elevation varied from about 813 to 811. Under the latter, submergence of the draft-tube bottoms was 2 ft less than originally expected.

Because of scouring the river bottom below the dam, tailwater elevation started to drop to increase the effective head on the turbines with headwater elevation remaining constant. At times, lowering of the tailwater caused loss of seal in draft tube *A*. This suggested the possibility of losing the vacuum in the remaining draft tubes with a corresponding loss in power, which in time happened. By 1917, lowering the tailwater elevation not only caused major loss of power from the existing turbines, but also unsatisfactory operation.

Regaining Draft Head. To regain the loss in draft head, plate-steel extensions were added to the downstream faces of draft tubes *A*. These increased the



DRAFT TUBES. The runners, arranged in pairs, discharge into short concrete draft tubes, *A*, *B*, *C* and *D*. Tubes *A* and *D* are single discharge, *B* and *C* double. Changes made in the tubes regained head because of the tail-water level being lowered

plant's peak capacity from 6200 to 8200 kw, by recapturing part of the usable head, lost because of lower tail-water level. Later, plate-steel extensions were added to the downstream faces of draft tube *B* on units No. 3 and 4. These plates also increased the submergence of draft tubes *C* and *D* to improve operation of these runners.

Turbine-Runner Trouble. Each pair of runners was only keyed to its shaft without other means of securing it in place. Four years after the plant started, No. 6 runner on unit No. 1 moved out into its discharge elbow. The elbow was damaged and the runner broken. Allis-Chalmers built a new runner, and did the same in 1918 when No. 6 runner on No. 4 unit was damaged. To prevent the runners from again working along the shaft, a cast-iron spacer 4 in. wide was placed between their crown plates.

The spacers, made in halves, were bolted together and keyed to the shafts, and the two runners were held together by bolts through their crowns. But after one or two years' operation the spacers broke because of shaft deflection, and runner fits were getting loose on their shaft.

To correct these conditions, the cast-iron spacers were replaced by steel-clamp ones, keyed and doweled to the shaft between the pairs of runners. Through them, the runners were bolted together. The runners were keyed to the shaft by three equally spaced tapered keys. When this trouble developed on other units, plate-steel spacers about 4 in. thick, made in halves, were welded to the shaft. Through-bolts at their rims held the two runners together.

Propeller Unit. By 1925, mechanical difficulties with old No. 1 unit required that something be done. An increase in the power company's 60-cycle load led to replacing this unit with a new vertical shaft—Allis-Chalmers single-runner propeller turbine and governor. It was designed and installed to produce not less than 3100 hp at 138½ rpm with the then normal tailwater elevation of 810, and to operate satisfactorily with a minimum tailwater elevation of 807. The turbine, connected directly to 2750-kva 0.80-pf 4000-v 60-cycle generator, went into operation in 1926.

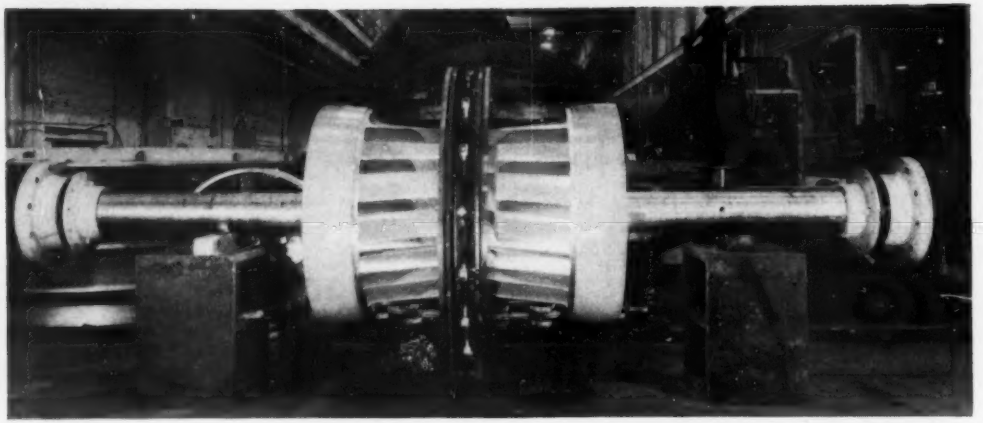
Except for inspection or repairs, this unit is kept in almost continuous operation. It has movable vanes for hand adjustment at the turbine coupling with the unit at rest, but adjustment is usually kept set for best average conditions.

Installed in the same width of powerhouse, the new propeller turbine produced 55% more power than the old 6-runner unit, and at 38% higher speed. While comparative field tests are not available, it is conservatively estimated that best efficiency of the new unit is 5 to 10% better than the old multi-runner one.

Installation of the new unit presented a number of problems. It could have been set in the old flume space, upstream of the powerhouse. But because the installation cost less, the new unit was placed downstream of old No. 1 turbine, in the generator room where it could be serviced by the existing powerhouse crane. This brought the top of the new turbine on about the same level as the existing generator floor, with the generator on a new floor above it. Space was not available for the best type of long, curved, concrete draft tube, so a straight, tapered, flaring plate-steel one was used and the tailrace floor elevation kept at 793 as before.

The original Lombard oil-pressure governors installed with the 6-runner horizontal turbines in 1909, were the closed vacuum-system type. Each unit had a triplex belt-driven pump, two pressure tanks, and a vacuum tank. The vacuum system gave trouble so it was changed to an open system with unloading valves, and the vacuum tanks were eliminated.

Later, troubles were experienced in connection with the operating heads of



NEW RUNNERS. Two of six runners of new design mounted on their shaft to replace the old 6-runner horizontal-shaft turbines. Each runner has die-formed plate-steel buckets, welded into a cast-steel crown and rolled-steel discharge and sealing band

the governors. This led in 1941 to the development of an adapter, which permitted using new Woodward governor heads. New motor-driven gear oil pumps and pressure tanks were also installed.

Turbine Shaft Breaks. After installing the new unit in 1926, the downstream shaft section of No. 3 six-runner unit broke. Being nearest to the generator, this shaft section put the unit out of service until it could be replaced.

When the shaft broke, the pair of runners on it also broke, which in turn broke the crown plates and curb rings. Two new cast-iron runners with similar characteristics, as well as the new main shaft for them, were made as quickly as possible. Both runners were keyed to the shaft, but the shaft was made with a shoulder to prevent one runner from shifting downstream. Crowns of both runners were then bolted together as in earlier repairs with a steel spacer in halves clamp-bolted to the shaft between them.

New Turbine Shafts. When the shaft trouble in the downstream section of the No. 3 unit was repaired precautions were taken to prevent this trouble occurring in the remaining units. A new downstream section shaft was ordered first for unit No. 4, and later for unit No. 2, both of improved design.

These shafts were designed with the 4-in.-thick distance piece or spacer forged integral as a flange on the shaft. The keyed runners on each side of the flange were then bolted together through their crowns to prevent them moving apart.

In 1942, when the farthest upstream shaft section of No. 2 unit broke, the integral flange design was again used for this new shaft. But this time the two runner hubs were bolted together through the integral flange on the shaft, in addition to having their crowns bolted together.

Changeover Program. A gradual reconstruction program for changeover of the horizontal units from 25 to 60 cycles was started in 1935. No. 3 generator was rebuilt at the plant for 60 cycles, 4000 v, with maximum capacity of 2500 kw. No. 4 generator was similarly rebuilt in 1937, and No. 2 in 1939.

With the rebuilt generators' rating increased from 1500 to 2500 kw, ways were studied to increase the power and efficiency of the remaining old turbines. During World War II, demand for more power continued to increase to such an extent that something had to be done. Allis-Chalmers was again called on to work out designs and by tests to determine the best means of reconstructing the old horizontal 6-runner units. Purpose was to increase their capacity as much as possible without an increase in speed when operating with tailwater elevation 808 and lower, and at good efficiency. The new reconstruction parts for each unit ordered were heavier main shafts, runners of modern design, new crown plates and curb rings with large guide-vane bolt circles for increased capacity. New units were designed to use other existing parts, including wicket gates and draft-tube chests.

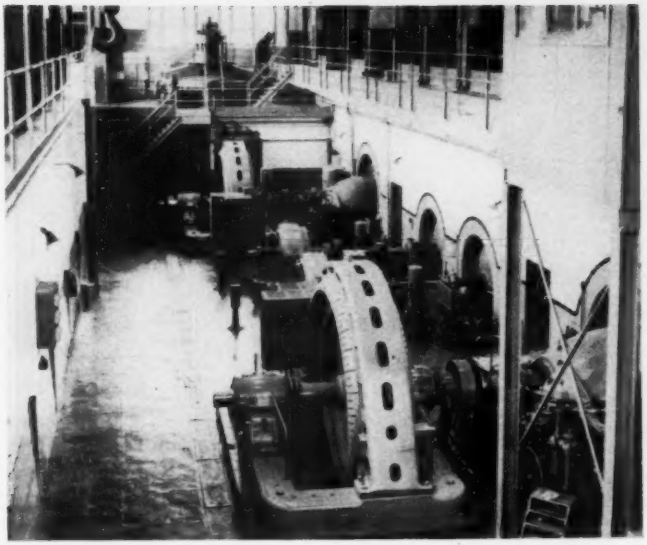
Runner-Model Tests. New francis test runners were designed and built as closely as possible to meet plant's needs. Model turbines were designed with a single runner. Draft tube was constructed to stimulate one-half of one of the double-discharge tubes of the original 6-runner unit. Half the double-discharge draft tube was chosen for testing the several runners because it was thought this would represent the worst condition at the plant.

Four francis-model runners were built: Tests on all of them, when stepped up to actual 6-runner plant size and operating conditions, showed over 3600 hp could be expected of the designs. Two runners developed a top efficiency of over 85%, which was acceptable considering the setting and the double-discharge draft tubes. The model runner selected as being most suitable for the plant showed that its prototype would have an efficiency of 81% at 3640 hp; 86% at 3440 hp; 86.9 at 3250 hp; 85.5 at 2720 hp; 81% at 2160 hp.

Efficiencies given are those of the model-turbine test without any increase for the stepped-up power. A plotting of test results showed runner efficiencies above 85%, from 2400 hp to over 3500 hp.

New-Runner Construction. Each new 57-in. runner was made of die-formed plate-steel buckets welded into a cast-steel crown and into a rolled-steel discharge band. Each of the much heavier shaft sections had a heavy flange forged integral with it. The two runners of each pair have their hubs bolted together through this flange.

In addition, the outer rims of the runner crowns were designed to contact, and where they touched they were welded together. After being bolted to the shaft and welded, each runner was given a final machining. This bolted-and-welded construction strengthened the shaft where it is loaded the heaviest and helps prevent deflection.



PLANT INTERIOR. The generator as it is today after it was modernized and changed from 25-cycle to 60-cycle power generation with 65% capacity increase

Rebuilding the units was done during low-water winter seasons so as to interfere as little as possible with power generation. Unit No. 4 was rebuilt in 1946, unit No. 3 in 1947, No. 2 by early spring of 1948.

Manhole Tubes. Each original 6-runner turbine had long manhole tubes *M*, from the floor above the flume to the draft chests to reach the turbine bearings. These tubes were found to disturb flow to the runners, so they were removed and covers put over all the bearings. Drains, vents, sight gages and temperature gages were brought out into the generator room. Here the bearings can be readily observed and their performance checked.

The old design had umbrella structures in the flume above each pair of runners to guide the water to them. These umbrellas were rebuilt, flattened out, and raised several feet to improve water flow to the new runners.

As previously mentioned, some of the draft tubes were lengthened to improve tailrace conditions. To further improve them as the tailwater got lower, a plate- and structural-steel-curtain wall was extended downstream from the turbines, about 8 ft across the draft-tube chamber. It gave good submergence in the tailrace for all the draft tubes. This was first done in 1939 on unit No. 2. When the other 6-runner units were rebuilt similar steel-curtain walls were installed on them.

Exciter Capacity. Because the old horizontal units had been rebuilt for 3600 hp and 2500 kw, it was necessary to increase the rating of the two waterwheel exciters. When No. 1 main unit was being rebuilt, No. 1 exciter was shipped to the manufacturer and its capacity increased from 150 to 187½ kw by installing interpoles and forced ventilation. A new shaft and larger runner were also added. Later, No. 2 exciter was similarly rebuilt.

A number of ventilators with fans installed in the downstream wall of the generator room bring in cool air and help all generators operate at lower temperature.

Forebay Size Increased. When the plant was put in operation entrances from the river to the forebay restricted flow to the headrace. Increased flow for the rebuilt units caused 6-in. loss in head. To correct this condition, an auxiliary entrance to the forebay (a canal 45 ft wide, 120 ft long, 25 ft deep) was excavated from the rock embankment upstream of the original water passage. This entrance reduced the head loss from 6 to 2 in. with appreciable gain in power.

Trash Rack. Like many other rivers, the Wisconsin brings down a lot of trash and debris, especially during high-flow seasons. Even though much of the larger floating pieces can be deflected by booms before they enter the headrace, debris is troublesome as in other plants. While the trash-rack bars are spaced 5 in. apart for the 3100-hp vertical-propeller turbine, their spacing is 2.25 in. for the horizontal units.

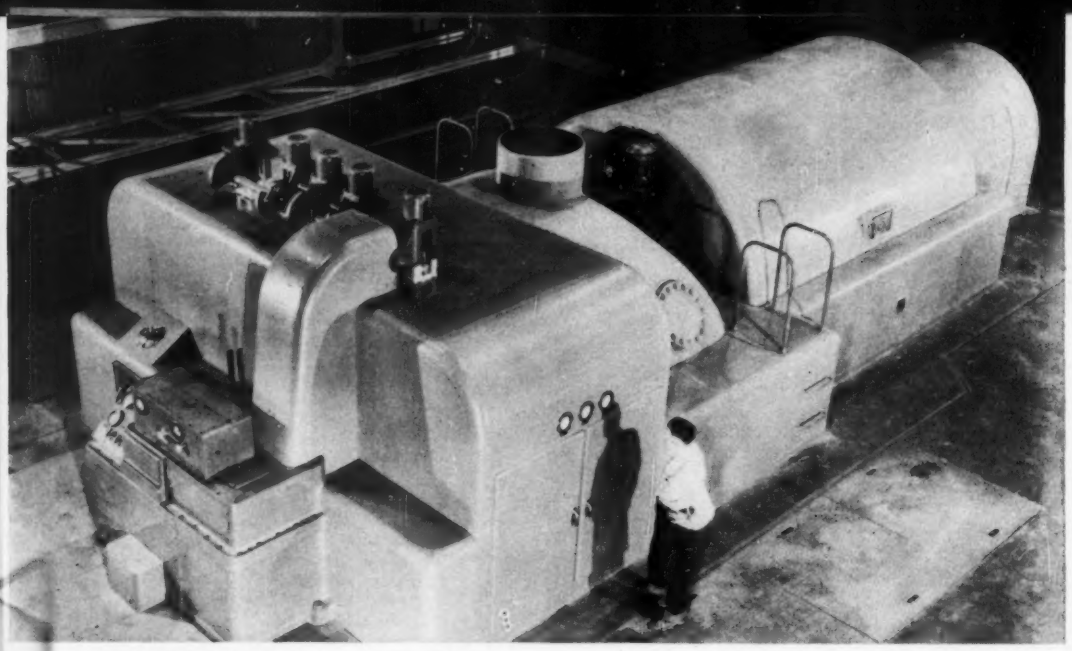
In 1920, the company built a mechanical rack raker, which could be moved from one flume entrance to another for cleaning the racks. This not only decreased the labor of keeping the racks clean, but increased the turbine output during flood seasons when so much trash comes down the river.

Dam Repairs. Only a few years after it was built, a flood washed out the lower cribbing of the downstream side of the dam. From then, continuous maintenance was required to insure the dam's safety. These difficulties were increased because low tailwater exposed the wooden cribs to the air and caused them to deteriorate. In 1935, to correct this condition, a concrete toe dam was built down to solid rock, about 10 ft downstream from the old dam. It extended between the rock abutments on the west side and to the concrete abutment wall on the powerhouse side.

Its height is such that water leaking through the old dam always keeps the old timber-crib sections submerged. Leakage water from the old dam discharges over a weir into the tailwater. Total leakage, which is very small, can be seen as it passes over the crest of the weir.

To further increase the dam's safety, space between the rocks in the rock-filled timber-cribbing was recently filled with concrete grouting. This was done by drilling through the concrete crest of the old dam and forcing grout by pressure into all old rock-filled cribs. This work was subcontracted through the Intrusion Prepakted Corp of Ohio. It is expected that this grouting will prevent settlement or misalignment of the dam.

Increased Power Output. While water flowing into the Wisconsin River varies from year to year, power generation in Kilbourn plant has increased steadily with a peak in 1942 of nearly 75-million kwhr. Increased output is the result of: (1) recapturing usable head lost because of gradually receding tailwater elevation (2) modernizing hydraulic turbines (3) revamping generators and exciters to increase their ratings (4) eliminating loss through the forebay entrance. Original installed capacity of 6000 kw, occasionally producing 6200 kw, has been increased to 9700 kw with occasional loadings up to 10,000 kw. Maximum daily output of 40 years ago was only 144,000 kwhr, while today it sometimes reaches 240,000. Recapture of losses caused by receding tailwater elevation improved the effective head about 25%, which with improved design of machinery and structures has increased plant capacity 65%.



SHEET-METAL JACKETING gives compact finished appearance to unit besides performing practical function to protecting insulation just as earlier lagging did. It also provides an air-insulated space for all piping and auxiliary equipment

How Your Steam Turbine Is Insulated

By C H **TeBRAKE**, *Steam-Turbine Dept, Allis-Chalmers Mfg Co*

► IN THE EARLY DAYS, little thought was given to heat loss from piping and engine parts. Steam pressures and temperatures were low, and fuel cost was reasonable. Some lagging was used, but primarily to protect operating personnel from burns. It also helped to reduce boiler and turbine-room temperatures. Early forms of lagging included wood, rags, gypsum plaster, and some types of clay used with mixtures of rope fiber, straw and hair as binding material.

During the early 1880's carbonate of magnesia began to be applied as insulating material to water and other fluid vessels. We have no data on the type of insulation used on the first turbine built (in 1905) by our company. Probably it was magnesia, applied as plastic material in layers of about 1½ in. at the areas of highest temperatures.

Heat Conservation. Operating temperatures have steadily risen, paced by increasing fuel costs. Adequate insulation on steam turbines became an important consideration. Heat radiated to surrounding air reduces efficiency of the entire plant cycle.

Possible distortion of the turbine cylinder by subjecting one side to cold drafts creates an operating hazard. Under severe conditions this causes misalignment and damage to moving parts.

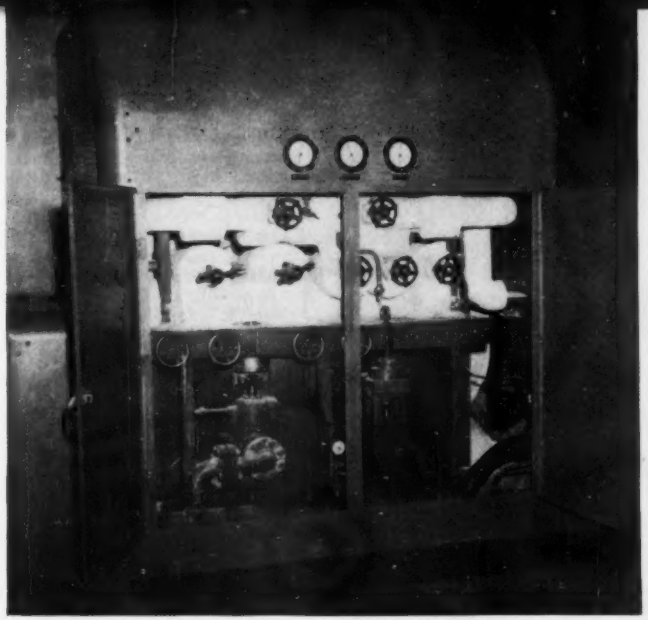
These conditions of loss and hazard can be controlled with various forms and combinations of magnesia and asbestos insulating materials.

Insulation. For surfaces with temperatures at and below 500 F, 85% magnesia has proved most economical. This material contains hydrated basic carbonate of magnesium, bonded with about 15% of asbestos fiber. The magnesia is the chief insulating component in this mixture because of its high percentage of minute dead air spaces that it contains. The asbestos fibers act as a heat-resisting reinforcement to add structural strength and long life. This material handles easily. It is clean, light and inorganic in nature. It does not char, burn, shrink or loosen in service. It has no corrosive action on the metal it touches.

When temperatures do not exceed 500 F, insulation of pipes and surfaces utilizes 85% magnesia in block or sectional form, applied in one or two layers to the total thickness needed for the temperature. An exception is made for pipelines, 2 in. and smaller. These are insulated to a maximum thickness of 2 in.

In applying block insulation, all joints and crevices are filled with plastic cement of like material. Where two layers are needed the joints are broken or staggered. After fastening the segmental insulation in place with noncorrosive wire, the entire outer surface is coated with ½-in. thickness of asbestos cement in two layers. Galvanized wire mesh reinforces the cement, which is troweled to a smooth, hard finish. Instead of a metal-jacket lagging, the exposed surface may be covered with a canvas jacket wrung out in cold-water paste, then pasted and stapled in place.

Subjecting 85% magnesia to temperatures above 500 F tends to calcine it on the hot surface. This produces a thick film of magnesium oxide, which possesses high insulating qualities but lacks structural strength. For this reason, a combination of insulation blocks is provided, which has an inner layer



INSULATION FORMS INTERMEDIATE SURFACE between turbine-casing surface and sheet-metal jacketing. Casing doors open to give access to piping and auxiliaries

BLOCK AND PLASTIC insulation cover turbine hydraulic throttle valve, strainer

INSULATING BLANKETS over the flange joints are easy to remove for repairs

LUGS IN PLASTIC insulation make anchor points for blankets covering joint

Function of steam-turbine insulation has changed over the years. Here's an authoritative description of the need for insulation and how it is applied to the units

to withstand the higher temperatures and preserve all the inherent qualities of the 85% magnesia. Specially selected precalcined diatomaceous silica, blended and bonded with asbestos fiber, composes the inner layer. Such material, though high in refractory value, is usually lower in insulating value and higher in cost than 85% magnesia. Thickness of the high refractory layer is kept to the minimum needed to assure an interface temperature of not over 500 F.

Insulating Blankets. Because operating conditions involve temperatures calling for insulation thickness up to 5 in. or more, removal of insulation for turbine inspection and repair is usually difficult, destructive and costly. To avoid the necessity of breaking the insulation on flanges and covers that must be dismantled occasionally, a blanket type of material is made. These blankets consist of asbestos cloth in mattress form.

Three types of asbestos are commonly used in the insulation field. They all belong to the fibrous variety of hornblende, one of the amphibole minerals composed mainly of silica, magnesium and calcium. They often contain aluminum and iron. Chrysotile, or white asbestos, has extremely fine, strong and elastic fibers, can be spun and woven, ideal for cord and cloth materials.

Crocidolite, usually called blue asbestos because of the dull lavender color given by its iron content, compares with white asbestos in its physical and insulating qualities. Amosite, or brown asbestos, is comparable to white and blue asbestos in many ways, but has somewhat shorter fibers. Because of its lower cost, this material is used extensively for reinforcement of the magnesia blocks and for filling in the mattress type of covering.

Blanket cloth is usually woven of white asbestos. For high temperatures the cloth is woven of monel-wire-inserted yarn and sewed with yarn of the same material. The stuffing is usually brown asbestos, made with a uniform thickness and density of not less than 12 lb per cu ft.

All blankets are closely tufted to prevent sagging. They are fitted with hooks or rings for attaching to surfaces to be insulated. Blankets are usually applied to horizontal flanges of the cylinder casing, throttle valve cover and connecting flanges, steam strainer cover, and such other surfaces as will require dismantling. The blanket is applied in one or two layers to the total thickness needed for the temperature. In general, blankets are arranged in two layers with joints staggered, except where cap or muff types lend themselves more readily as on pipe flanges or vessel covers. For the latter, single layers are made up as needed.

A noncorrosive wire, such as monel, is used to lace the blankets together and to the lugs, which are screwed or welded to the surfaces to be covered.

Insulation methods we have talked about have been used for many years, though we have always been alert for improved and more economical methods.

There are, of course, many other types of insulating materials, such as rock wool, spun glass, aluminum foil, etc. Moreover, the industry is always developing new materials and methods for reducing heat losses. Each material possesses qualities that make them most suitable for certain specific applications and should be used where experience has proved them best.

Allen Hutchison, *at right,* chairman of technical sessions; and **Professor D L Mordell,** who gave paper on gas turbines

Arnold A Smith, Canadian International Paper Co, Three Rivers, Que., presenting his paper, *Conversion from Coal to Oil*

Group of outstanding power engineers at the convention. *Left to right:* **Henry Breard,** Gamelin Chemical Co, Quebec City; **Harvey E Larocque,** Lake St. John Power & Paper Co, Dolbeau, Que.; **R G Edwards,** International Paper Co, Dalhousie, N. B.; **G R Benskin,** Gamlen Chemical Co, Canada, Ltd, Montreal Que.; **William C Child,** Gair Co of Canada, Toronto, Ont., general secretary, the Institute of Power Engineers

IPE Holds Tenth Annual Convention

► WITH THE WINDSOR HOTEL as headquarters, Montreal played host to the Institute of Power Engineers during its tenth annual convention, Oct 19 to 21. Nearly 500 members and guests attended. For three days, activities continued from early morning to late in the evening. These included five technical sessions, three luncheon meetings and three banquets.

The convention opened with a luncheon on Thursday at which Dr Leon Lortie, member of the city council and professor of chemistry at University of Montreal, welcomed the Institute members and talked on power generation.

At the Thursday afternoon session Professor D L Mordell, professor of mechanical engineering, McGill University, reviewed development of the gas turbine. He told how three types of these turbines had been developed for different heat cycles. Forty-one such units representing 143,000 hp are in operation or under construction in the United Kingdom; 33 in Europe, totaling 238,000 hp; and 22 in the United States for 86,000 hp. Thermal efficiencies up to 34% had been obtained in Europe. By recovering waste heat from the turbine exhaust, thermal efficiencies up to 40% are probable.

Philip W Swain, editor of POWER, told on Friday morning how to go places in engineering, after which he talked on protection against the atom bomb. He said it is *not* true that, (1) there is no protection against an atom-bomb burst (2) harbor or river underwater bursts are the best way to attack a city (3) low air bursts are more deadly than high bursts (4) most deaths are from radioactivity (5) residual radioactivity will keep people from moving back (6) heat of bomb will melt steel like wax. Swain closed his program by showing the official colored moving pictures of the Bikini bomb explosions.

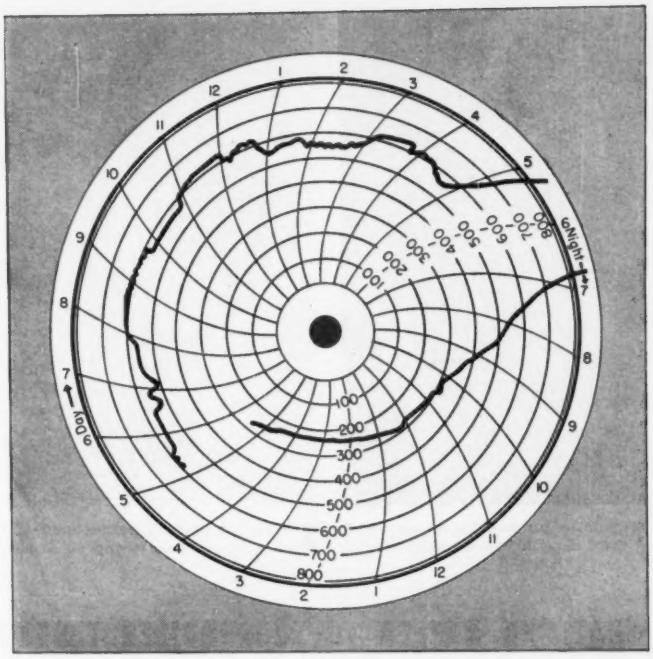
Otto de Lorenzi, director of education, Combustion Engineering Corp, spoke on burning liquid and gaseous fuels with different types of burners. After a comprehensive review of the subject the speaker demonstrated his talk with colored moving pictures showing how different fuels burn. Pulsations caused in the furnace by fuel pumps and by draft-fan blades could be clearly seen in the flame.

A symposium on feedwater treatment was presented Saturday morning: (1) *The Case for or Against External Treatment,* by W L Andrews, Bird-Archer Co (2) *The Use of Anti-Foam in Carryover Prevention,* by W J Tomlinson, E F Drew & Co (3) *Corrosion in Boiler Feedwater Systems, Causes and Prevention,* by L E Horembala, Alchem, Ltd (4) *Return-Line Corrosion and Its Prevention,* by R H Hayman, Betz Laboratories, Ltd and (5) *Internal Chemical Treatment for the Prevention of Scale Deposition,* by Paul Gervais, Magnus Chemical, Ltd.

The technical sessions closed Saturday afternoon with a paper, *Conversion from Coal to Oil Fuel for Steam Boilers,* by Arnold A Smith, Canadian International Paper Co, Three Rivers, Que. Smith said that the most important factor in making such a conversion is to obtain a good over-all engineered job. It is not enough to have good equipment, it must be selected so it works as a unit, installed and adjusted to give best results. The decision to use fuel oil instead of coal may be based on the saving in cost of operation, or on such factors as cleanliness, availability, ease of storage and delivery.

Nail down causes of low-water accidents in watertube boilers with practical tests Harry Spring and Dyer Carroll give here. You'll also be able to answer the puzzling question that will always pop up . . .

Which Happened First?



1 Flue-gas temperature chart is valuable evidence in low-water accidents. Here the chart shows gradual rise in gas temperature as the water level in drum recedes

► FINDING THE CAUSE of low-water accidents in watertube boilers is difficult at times. The boiler operator can often report important events immediately preceding the accident — if he will. Some, however, may be quite honest but so alarmed by exploding tubes, escaping steam and excitement of others that they cannot clearly recall exact details. Sometimes, misleading information has been given to cover operating mistakes.

The big question in any low-water accident is, what happened first. Did a tube rupture from some local cause with resulting low water and overheating? Or did low water occur first and then the tube rupture from overheating? The table, p 121, lists a number of factors that must be studied to determine what happened first. Knowing this, we have a better chance of putting a finger on the exact cause of accident.

Common Causes. Scale or oil on a tube prevents transmission of heat to water inside and causes tube metal to overheat. When metal temperature becomes excessive, rupture occurs, Fig. 3. Escaping water may then lower level in boiler to a point where heat, from both furnace walls and fuel bed, damages other tubes by overheating them.

If we approach our problem from the opposite end, water level in boiler may be allowed to decrease until a tube ruptures. First warning operator has is sound of tube letting go. He cuts off the fuel supply to extinguish the fire as quickly as possible. Inspector is then faced with the recurrent problem of many overheated tubes and one or more that may have ruptured.

Using Table. Let's now look over the table and examine more completely the factors listed.

Defective weld: This is readily determined by macroscopic examination. If rupture has not necked down to a knife edge and has practically full thickness at torn edges, you might suspect an overheated or defective tube, or a defective weld.

With a saw, cut a piece of tube from one end of the rupture. This piece should be about ½ in. high. File the ring edges smooth and immerse in a solution of about 50% nitric acid and 50% water. Boil for about 30 minutes to macroetch edges. Examination of tube edges shows the weld metal in line with fracture if tube is welded. It also shows internal defects, such as lack of fusion, porosity or slag inclusions. Always pour acid into water, never the reverse. Spattering may cause severe burns. Handle sample with tongs and flush thoroughly with water before touching with bare hands.

Scale or oil: Rupture practically always thins down to a knife edge with much bulging, Fig. 3. Be sure to examine other tubes for scale and oil because these substances may be blown out of the ruptured tube. A coating of scale 1/16 in. thick on watertubes exposed to radiant heat may cause tube failure. Proper treatment of feedwater and regular blowdown are necessary to prevent scale formation in the tubes. Besides protecting tubes, treatment and blowdown also reduce scale in the boiler drums. Any substance that cuts down heat transfer must be removed.

Hydrogen embrittlement: This is not too common a cause of tube failure. It is said to occur at temperatures of about 700 F and usually results in blowing out a piece of tube. Consider location of tube to determine if wall temperature reaches 700 F during operation. Laboratory investigation is needed to prove this was cause of tube rupture.

Defective tube: Be careful of the

2 Burning and oxidation of watertubes may result from extreme overheating

3 When overheated tubes rupture they open up like this, release the water

4 Bowing may not be serious if tubes are unburned. Check baffles, ends

WHAT CAN HAPPEN TO YOUR BOILER TUBES WHEN THEY OVERHEAT

term "defective material." It is often misused. Chemical analysis of tube metal is necessary to show if *Code* requirements were followed by steel mill. Microscopic examination might show dirty steel, but quantities of slag usually found preclude tube failure unless it forms a definite lamination. Material defects caused by improper heat treatment or by working metal at too high or too low a temperature may be revealed by microscopic examination.

Recording charts: Flue-gas or superheat temperature, as shown on recording charts, gives valuable evidence as to which occurred first, rupture or low water. Steady rise of flue-gas temperature into abnormally high ranges, Fig. 1 indicates that low water developed gradually and not suddenly as a result of a rupture.

Comparatively greater spheroidization of tube at all points above rupture shows there has been prolonged overheating. Fig. 7 illustrates change in grain structure accompanying spheroidization. You must use a microscope for this examination.

A laminar pearlitic structure adjusts itself with the carbides changing from laminar to spheroidal shape when exposed to temperatures of about 1200 F for a period of time. Prolonged exposure to higher temperatures causes grain growth and radical changes in microstructure. Photomicrograph in Fig. 5 shows normal steel in boiler tube below zone of overheating. Fig. 6 shows same tube in the overheated area. It is estimated temperatures were in 1500-F range for about half an hour. This would not be likely to occur if overheating were rapid, tube ruptured, and fire were immediately withdrawn.

If water level was accidentally permitted to go too low and tube rupture followed, there would be severe overheating of all parts exposed above rupture. The recording temperature charts would tell the story. It could further be substantiated by metallurgical examination. In cases of extreme overheating, surfaces of tubes will actually be burned and oxidized, Fig. 2. Rupture of tubes will usually be severe under these conditions and practically always have the appearance of a brittle failure. Reason for this is loss of ductile properties at high temperatures existing.

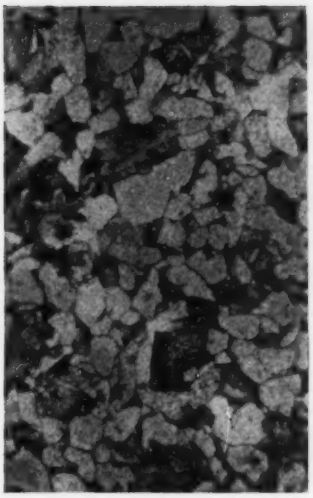
Low Water First. With a string, measure circumference of all tubes exposed to fire. Take these measurements at different elevations above bulge. If tubes are appreciably swelled it is probable that low water occurred first, then tube rupture. The tubes were overheated for a prolonged period and pressure inside them was sufficient to cause swelling. If rupture occurred first the pressure would have dropped rapidly and would not have been sufficient to cause swelling by the time tubes became overheated.

Watertubes also bow when overheated because side facing fire is weakened more than side away from it. Bowing in itself, Fig. 4, may not be serious if tube is unburned. Check to be sure baffles are not dislodged. Also, tube ends may slip in the rolled joints.

Flue-gas temperature rises gradually when water level is low. This is different from rupture first, because flue-gas temperature rises rapidly then. As temperature increases with low water, the water level decreases. Finally, there's a drop in steam pressure and flow. All tubes in high-temperature zone will be swelled above rupture.

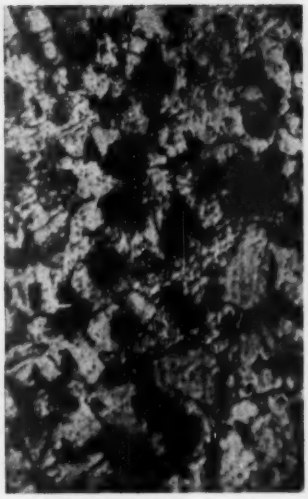
Besides evidence in the boiler furnace there may be other clues to the correct answer. Blowdown valves left open by mistake, a plugged water column, faulty feedwater regulators, gage glasses shut off, and other similar causes indicate what might have been responsible.

In all such investigations it is well to go by physical evidence at least as much as by what one is told. Between the two a correct answer may be obtained.



5 Photomicrograph shows pearlitic steel unaffected by the heat in the furnace

6 Same tube as in Fig. 5 but this part was in 1500-F region for half an hour



7 Spheroidization is a change in steel grain structure, occurs about 1200 F

PHOTOMICROGRAPHS CAN HELP PROVE CAUSE OF SOME FAILURES

RUPTURE FOLLOWED BY LOW WATER

CAUSE AND PROOF

1. Defective weld: Macroscopic examination of cross-sectional area shows failure in weld. Visual examination reveals little or no thinning of fracture edges
2. Scale or oil: Visual examination shows severe bulging and thinning down. Other tubes must be examined for scale or oil deposits because ruptured tube may be blown clean
3. Hydrogen embrittlement: Metallurgical examination of polished and etched specimen of tube usually shows inter-crystalline cracking. Occurs at temperatures in 700-F range, so tube location will be a factor
4. Defective tube: Metallurgical examination under microscope and possibly a chemical analysis are needed to prove this cause

REMARKS:

Inspection of recording sheets for flue-gas temperature and steam flow or pressure will show sudden rise in flue-gas temperature at time pressure drops and steam flow is interrupted if failure is from sudden rupture. Microscopic examination may show slightly greater degree of spheroidization of tube above rupture than below.

LOW WATER FOLLOWED BY TUBE RUPTURE

EVIDENCE PROVING THIS CAUSE

1. There is a greater degree of severe overheating of all parts exposed to high-temperature gas. Watertubes will be bowed and are usually burned
2. Recording sheets show a gradual rather than a sudden rise of flue-gas temperature to abnormally high values. Rise precedes loss of steam pressure and flow
3. Microscopic examination of tube above rupture usually shows much greater degree of spheroidization than below the rupture
3. Tube rupture may not show much bulging or necking down. Burned-tube failures sometimes resemble appearance of brittle failures
4. All tubes in high-temperature zone will be found swelled above the rupture

REMARKS:

Causes of low water should be investigated carefully. They include blowdown valves left open by mistake, obstructed water column, feedwater-regulator failure, gage glasses shut off and other similar causes that allow water to escape from boiler or prevent operator from seeing correct level.

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

33—Motor and Generator Exciters

►WHERE ONLY ALTERNATING CURRENT is available and wide speed ranges are required, variable-voltage control is used extensively in industrial power applications. Such control can be applied economically to any size drive and offers speed flexibility and advantages not easily obtainable by other means.

Variable-Voltage Control. These controls require a dc generator driven by an ac motor, a dc motor on the driven machine, and an exciter for the dc generator and motor field coils. Usually the ac motor, dc generator and exciter are assembled as a unit. A rheostat in the generator or motor-field circuit or in both adjusts the dc motor's speed.

In many of these applications an electronic exciter is used instead of the rotating type driven by the motor generator. Electronic exciters provide great flexibility of control and make it possible to obtain complex control features with relatively simple low-power electronic circuits.

When used with variable-voltage motor-generator sets these exciters can provide preset speeds with controlled definite-time acceleration and retardation, combined voltage and field control with full motor-field control. Either dynamic or regenerative braking can also be had.

Simple Electronic Exciter. Fig. 1 diagrams a simple electronic exciter (Reliance Electric & Engineering Co.). It is a single-phase, full-wave, uncontrolled dual-anode rectifier. Primary winding of transformer *PT* is in two sections arranged so they can be grouped for operation on 220- or 440-v ac power lines. Primary windings are also tapped and have a tap switch for voltage correction. A 2.5-v secondary winding in the transformers heats the tube's cathode.

Operation of Exciter. Assume the transformer connected to the line and polarity as arrows indicate. Current flows through the cathode to heat it. But the tube is not connected to the field circuits until time-delay relay *TDR* has closed contact *TD*, which requires from 30 to 45 sec, depending on unit's size.

When *TD* contact closes, excitation current is supplied to the generator and motor-field coils. This current flows from center tap *D* on the transformer through the field coils to *C* on the cathode transformer section, the cathode and anode *A*, through the left-hand half of the secondary winding to *D*. On reverse polarity, current flow reverses in the transformer, but has the same direction in the field circuits, with anode *B* and right-hand section of the transformer secondary in circuit.

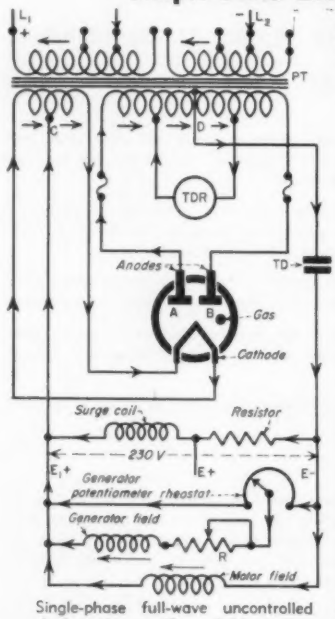
Exciter Capacities. These exciters are built in three sizes: 300 w, 1.2 amp; 500 w, 2 amp; and 750 w, 3 amp. Even though designed for exciter service these units may be used as a source of 230-v dc power within their rating for inductive loads, such as solenoids, magnetic chucks and similar applications.

When used to supply inductive loads that are switched on and off on the dc side, a discharge circuit is connected across the load. This circuit should be capable of limiting the discharge voltage to 1000 v or less. This condition exists when operating magnetic contactors.

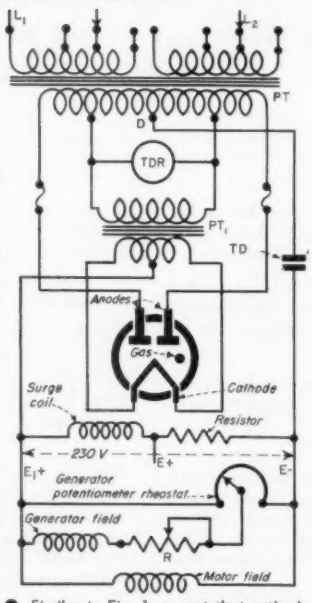
Fig. 1 has a separate terminal *E+* for the control circuit, which is connected from *E+* to *E—*. In this circuit is a choke coil and resistor, which acts as a discharge path and a surge-absorption circuit. This circuit materially increases tube life where the control is operated frequently.

Large-Size Rectifiers. Fig. 2 is like Fig. 1 but is used for a 1250-w 5-amp rectifier. In it the cathode-heating cur-

Simple Field Excitation Circuits



1 Single-phase full-wave uncontrolled dual-anode rectifier field exciter



2 Similar to Fig. 1, except that cathode heating is by separate transformer

Edward INSTRUMENT Valves

For Orifice Meters, Regulators, Gage Lines, Instrument Panels, Christmas Trees, By-pass Lines, etc.

HERE'S A NEW DESIGN in instrument valves — forged steel for strength in high temperature or high pressure service; no bonnet joint, swing bolted gland for easy packing adjustment.

Compact enough to fit the limited spaces of panel boards, this new Edward instrument valve is especially designed for close regulation on meter and regulator lines, too.

Built in globe or angle design, screwed or socket welding ends, ¼ in., ⅜ in., and ½ in. sizes. Working pressure ratings 6000 lb WOG, 1500 lb at 850 F with carbon steel bodies, and 1500 lb at 1000 F with 13 per cent chromium EValloy stainless steel bodies. Write today for Bulletin 491.

ACTUAL VALVE SIZE ▶

NEW FIG. 952 SERIES

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Please send me Bulletin 491—on Fig. 952 Series
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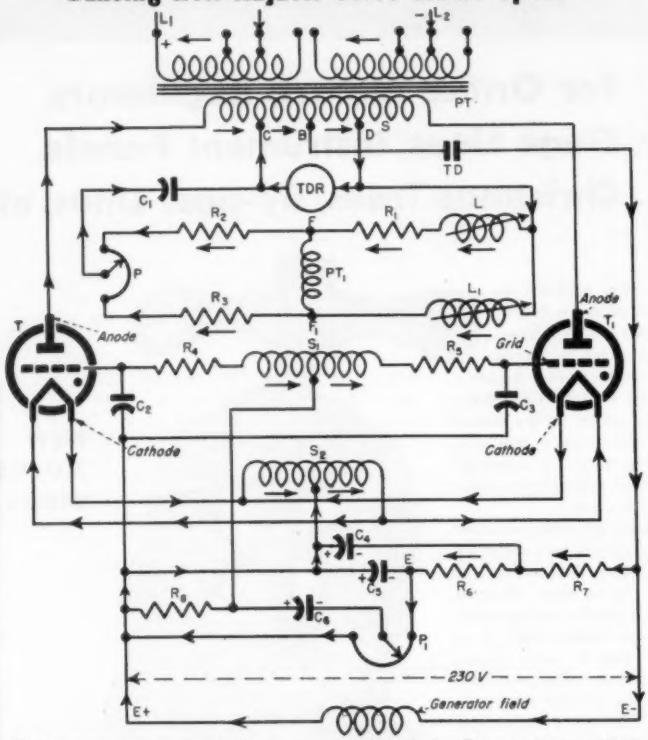
Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

Dancing Roll Adjusts Drive-Motor Speed



3 Electronic exciter for a drive-motor speed control. Purpose is to maintain constant tension loop of the material being processed by using dancing roll

rent is supplied from a separate transformer PT_1 instead of from a section of the secondary in the main transformer. Otherwise, the circuits are the same as for Fig. 1. On both diagrams, the generator and motor field-coil circuits are shown. Generator field has in series a voltage-limiting resistor R and a potentiometer rheostat. With the latter, generator voltage can be reduced to residual value. A rheostat is not shown in series with the motor field coils, but one may be used if the motor is to be operated above base speed.

Exciter With Speed Control. Fig. 3 diagrams an electronic exciter (Reliance Electric & Engineering Co.) that has speed-control features. It can be used as a constant-tension control from a loop in material being processed or to hold constant set speed. Connections as shown are for a control to maintain constant tension by using a short-stroke dancing roll running on the web of material being processed. As tension in the web changes the roll moves an iron core in a phase-shift device to adjust the rectified dc output voltage and thus control the drive motor's speed.

Phase-Shift Device. Phase shift is by a specially designed solenoid with two coils, L and L_1, mounted together on two iron cores. Cores and coils are arranged so when the core moves out of one coil it moves into the other. This makes a sensitive phase-shift device in which 9/16-in. movement of the core gives full control of drive-motor speed for the application.

Solenoid coil L_1 and resistors R_3 form a phase-shifter like that we have studied in connection with thyratrons. Also coil L and resistors R_1 and R_2 form another phase shifter. Coils L and L_1 connect together and to D on the transformer. Likewise R_3 and R_2 connect together through potentiometer P and to C on the transformer.

Primary of grid transformers PT_1 connects between the two phase shifters at points F and F_1. Then, the phase angle of the voltage applied to secondary S_3, and the grid bias on tubes T and T_1 is a combination of voltage of the two phase shifters. Voltage applied to PT_1 can be phase-shifted 180 deg to control tubes T and T_1.

Secondary S_3 of the grid transformers connects through resistors R_4 and R_5 to the grids of rectifying thyratrons T and T_1. To simplify the diagram, the grid transformer's secondary S_3 has been separated from its primary, PT_1.

Minimum Output Volts. Potentiometer P in the phase-shifting circuits adjusts minimum output voltage without affecting the maximum voltage. Turning arm A to its bottom position, put all of resistor P in series with the top phase shifter. When arm A is in its top position all of resistor P is in series with the bottom phase shifter. Putting arm A in one position limits minimum voltage to 20 v; in the other, minimum output volts is 200. Maximum is always 230 v. Where an output-voltage change of 230 down to 125 v gives sufficient speed range, potentiometer P is set for a minimum of about 120 v. This limits the range through which the speed can be changed and helps to stabilize the control.

Control Circuits. In this control the cathodes are heated from a section S_2 of the power transformer's secondary. Rectifier parts of this diagram are practically the same as Fig. 1 and 2. When transformer PT is energized to the polarity shown, heating current flows from S_2 through the cathodes as arrows indicate. Time-delay relay is energized from taps C and D. After a definite time the relay closes its contact TD to energize the generator-field coils. In this circuit, current flows from center tap B on the transformer to $E-$ through the field coils to $E+$. Then, through the right-hand section of S_2, tube T, and to the power transformer.

When tube T conducts we can assume that grid transformer S_3 has the polarity shown to put a plus bias on the grid of the tube. This potential is applied from the center tap on S_3, through R_5 the right-hand half of S_2 the cathode to the grid and to transformer S_3. Grid transformer does not have to put a plus bias on the grid for the tube to conduct. When the minus bias drops below the critical value the tube fires, after which the bias does become positive.

When ac line polarity reverses, the grid of tube T_1 becomes positive and this tube fires. Point on the ac-voltage wave where the tube fires is determined by the position of the iron cores in coils L and L_1. If the web feed is a little too fast the web slackens, causing the dancing roll to phase-shift the grid bias to decrease tube output and slow down the drive motor. Excess tension in the web has a reverse effect. In this

(*Continued on page* 164)

400° F.

350° F.

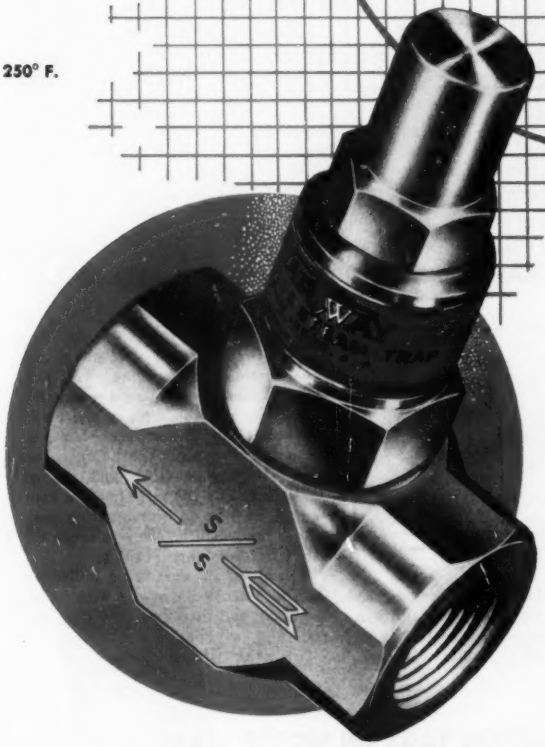
300° F.

250° F.

FOR EVEN TEMPERATURES

YARWAY

STEAM TRAPS



● Processes requiring careful temperature control call for Yarway Impulse Steam Traps on steam equipment.

The reason . . . Yarway traps maintain even temperatures because they *continually* sample and respond to a trickle of the condensate. There is no arrest in flow, no waiting for large quantities of condensate to accumulate, or trapped steam pockets to condense.

Other reasons why Yarway Impulse Traps have become first choice in many thousands of plants:

- **They get equipment hotter, sooner**
- **Small size, light weight**
- **Easy to install, easy to maintain**
- **Only one moving part**
- **Good for all pressures**
- **Stainless steel construction**
- **Low cost**

If you are not already familiar with these and other advantages of the Yarway Impusle Steam Trap, try one *for free* and find out for yourself. Call your nearby Yarway distributor, or write to:

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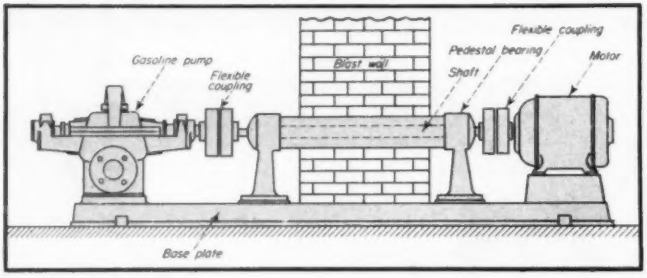
Stainless Steel Body

YARWAY IMPULSE STEAM TRAP

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

HOW WE ADAPTED OPEN MOTOR TO FLAMEPROOF SERVICE



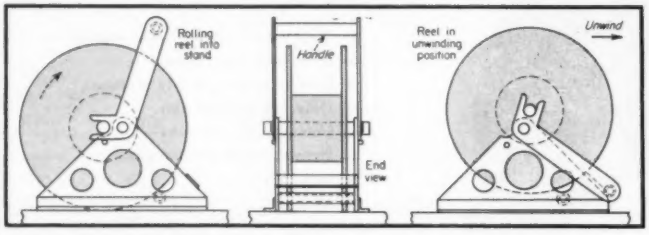
IN 1947, WE RECEIVED a job to install a pump (for handling gasoline) driven by a flameproof motor. Motor manufacturers in India don't make flameproof motors and it would take 9 to 12 months to get deliveries from foreign makers. Our customer couldn't wait that long so we had to adapt available open motors for the service.

The sketch shows how we arranged pump and motor on opposite sides of a blast wall. The motor drives the pump through an extension shaft turning inside a cover pipe built into the wall. To limit any possible leakage through the cover pipe it is filled with loose asbestos. Motor and its controls are completely enclosed in a fireproof room.

This arrangement was given complete approval of fire-insurance authorities. We have since installed six similar motor-driven pump sets for two different oil companies and all of them operate satisfactorily.

C A ABRAHAM *Madras, India*

STAND INCREASES EASE AND SAFETY IN HANDLING LARGE REELS



WE BUY OUR ELECTRIC WIRE wound on large reels. While this is the most economical way to buy wire, the reels are hard to handle because of their great weight. They become especially difficult if the rims are battered, even using the conventional type of cradle. This led us to make a number of stands, as shown in the sketch at the left.

These stands are of steel plates and pipe fastened by welding. The first sketch shows how to place a reel on the stand. The reel is simply rolled along the floor, between the side plates, so the axle enters the forked supports on each side. The handle is then pushed down. This lifts the reel from the floor and places it in an overbalancing position so the weight of the reel keeps the handle in the lower position.

To prevent the reel being pulled off the stand accidentally, the wire is unwound in the direction shown by the arrow.

L KASPER *Philadelphia, Pa.*

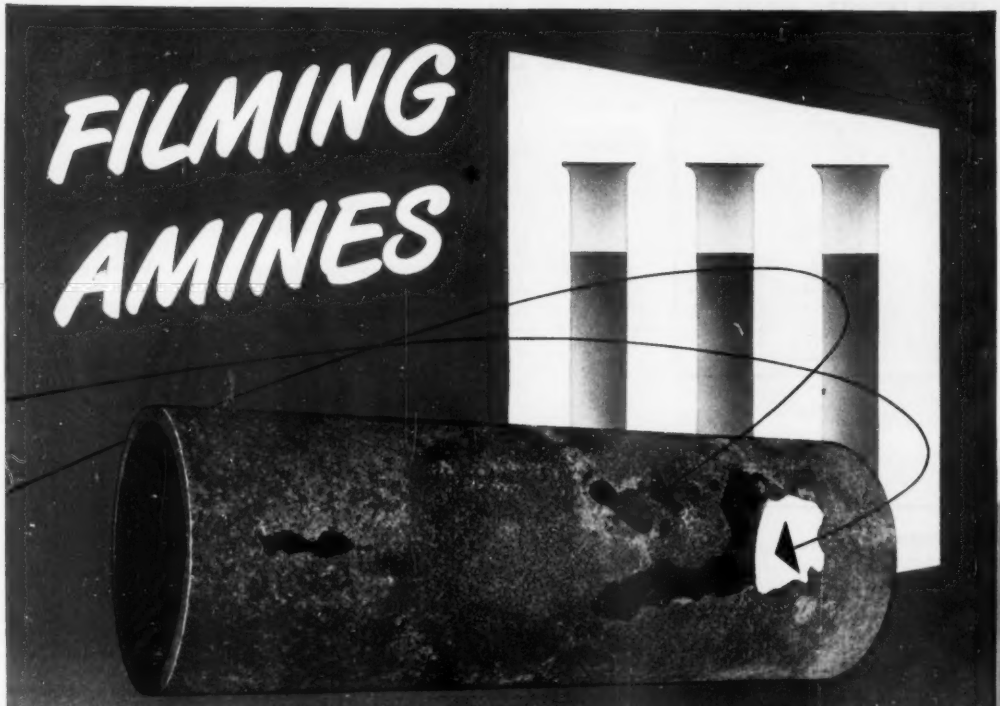
USE PERMANENT IDENTIFICATION TAGS ON MOTOR LEADS

MULTISPEED MOTORS are not too frequently used and only a few mechanics have to grapple with them on maintenance jobs. They use a lot of wiring between motor and controls and all these leads must be clearly identified. The most tedious and trying job is to reconnect a motor to leads whose identification tags have become unreadable because of weathering or other damage. Having been through this, I strongly recommend that anyone having such an installation protect himself by attaching stamped metal tags with wire binding to all leads. They should carry data such as: motor rpm range, elimination of jumpers on contactor panel for each speed range, motor leads marked and connections indicated such as: T1-T30, T2-T31, T3-T32, T7-T37, etc.

P C ZIEMKE *Oak Ridge, Tenn.*

For more plant-tested ideas, turn page

FILMING AMINES



Prevent Return Line Corrosion

Send for Betz Technical Paper #121, "How Filming Amines Prevent Steam and Return Line Corrosion."

CORROSION of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new advanced process for the prevention of return line corrosion employing *octadecylamine.* This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surface in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment.

Results? As high as 99 per cent reduction in corrosion rate has been achieved. Maintenance and replacement costs on return line systems have been reduced to negligible amounts.

Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation of course. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

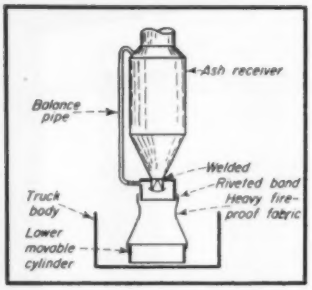
*U. S. PATENT 2,460,259
CANADIAN PATENT 461,238

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

 Continued from page 126

ADJUSTABLE UNLOADING CYLINDER MINIMIZES ASH DUST

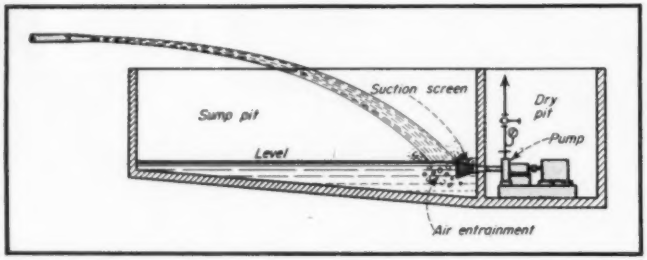


WE EMPTY our ash-evactor receiver once each day. A truck backs up under the receiver discharge gate and the ash drops into the body. The pulverized-coal ash sends up clouds of dust that have entered the plant. We found that it was getting into our equipment and causing some damage.

Our maintenance staff experimented with various arrangements and finally developed the scheme shown in the sketch. They welded an iron cylinder around the discharge gate and attached a heavy fireproofed fabric by riveting to the lower edge. The other edge of the fabric fastens to an open metal cylinder of larger diameter. A light winch, not shown, raises and lowers this cylinder. The cylinder is lowered onto the truck floor and the ash gate opened. This displaces from the cylinder air that is led back into the receiver through the balance pipe. Slowly raising the cylinder fills the truck body and very little ash dust seeps out around the edge. This scheme works when carefully handled.

J A SWANSON *Princeton, B.C.*

PUMP WEAR TRACED TO FAULTY CLEANING METHODS

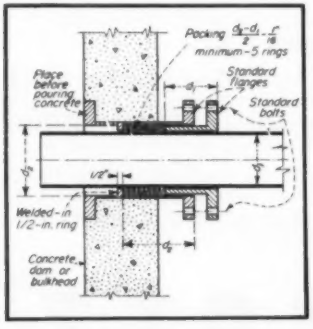


FREQUENT BOWL REPLACEMENTS needed on one of our sludge pumps made us take a close look at the operating methods. We found the pump was kept running after drawing down the sump level to the pump intake. The operator then flushed down the pit sides with a high-pressure hose. Finally he played the hose stream on the suction screen to loosen the fine material and clean the screen. He proceeded in this manner under standing instructions. We immediately became aware that the hose stream caused formation of a large number of air bubbles which were drawn into the pump, see sketch. These bubbles obviously caused cavitation and eroded the pump casing and impeller.

Washing instructions were changed to insure keeping a submerged suction on the pumps. Operators were also prohibited from playing the hose on the suction screen or anywhere in its vicinity. Six months after changing the method the pump was taken down and the internals were found in good condition, showing our analysis was correct.

J D CONSTANCE *Cliffside Park, N. J.*

STUFFING BOX AIDS PIPE REPAIR REPLACEMENTS



SKETCH SHOWS the standard design of stuffing box we use for pipelines running through concrete dams and bulkheads. An alert master mechanic came through with this idea. Most of our pipelines are pump suction lines, and when they need replacement a lot of work is involved. This gland setup was a step toward simplification.

A feature of the design is that standard pipe can be used. The proper size outside pipe, set in the bulkhead, chosen to give spacing for packing, from $\frac{5}{8}$ to $\frac{3}{4}$ in., is fitted with two welded-on flanges. One flange is standard, the other on the water side is either standard or improvised. The outside pipe is also fitted with a welded-on steel ring on the inside. The $\frac{1}{2}$-in.-thick ring is placed about a pipe diameter from the flange carrying the standard bolts.

A sleeve is turned out to fit between the two pipes and take up the packing. The sleeve has a standard flange to match the flange of the outside pipe. Standard bolts, of course, can be used to pull up on the flanges and compress the packing around the piping. We find that about five rings are the minimum packing needed. A greater number of rings require less bolt pressure.

J H QUAY *Rock Springs, Wyo.*

GET THAT IDEA ON PAPER...

. . . and send it in for publication consideration. You will get more satisfaction from knowing your ideas help others than from the $20 you will be paid for each accepted item. Your manuscript need give only the bare facts with sketches in pencil. We'll dress them up for publication.

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3 reverse, to 4.43 mph.

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WEIGHT: 27,500 lb. • 102 DRAWBAR HP.
GM 6-71 DIESEL ENGINE
SPEEDS: 6 forward, to 5.80 mph.
3 reverse, to 4.57 mph.

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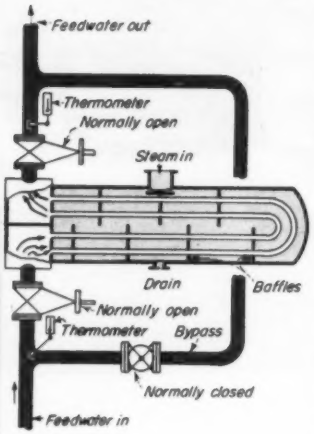
PROBLEMS FROM THE PLANT

This Month's Question:

HOW CAN I VENT SHELL-AND-TUBE HEATERS?

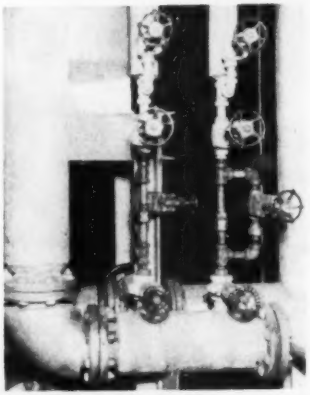


WE HAVE FOUR shell-and-tube feedwater heaters in our new power plant. Put into operation about a year ago, they worked well for the first few months. Lately, though, they've been losing capacity. Water temperature leaving heaters, see sketch, is 10 to 30 F below normal, sometimes more.

I believe the heaters should be vented to remove gases and other noncondensables. Some of the gang agree with me, but others say scale causes the trouble, not noncondensables trapped on steam side of shell.

Now what I'd like to know is how and where these heaters should be vented, where vent lines must be connected for best results, what valves are needed, how a vent header serving all heaters can be sized, and where vent piping must terminate to discharge non-condensables. Sketches of good piping hookups will be most helpful in solving the problem.—*HB*

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay



CONTINUOUS-BLOWDOWN lines from two boilers. Unions contain orifices

FLANGED FITTING is chemical feed line. To the right is the continuous blowdown

Readers Answer the October Question

How Can We Accurately Measure Blowdown?

(This question from the October issue is followed by best answers from readers.)

For several months we've been trying to measure blowdown from our six watertube boilers. But every method seems greatly in error.

First, we tried weighing the blowdown in barrels. We lost so much by evaporation that we figured results were way off. Next, we tried an orifice in each blowdown line. Orifices wore rapidly and were out of round in a few weeks. Same thing happened with flow nozzles. Latest method we've used is marking drum gage glasses. This is accurate but wastes quite a bit of time.

Now here's the problem. We have to get an accurate estimate of daily blowdown. But we haven't enough men in the plant to let an operator spend an hour or so on this job. What we need is a fast, accurate method of finding quantity blown down.

I need a setup that doesn't cost too much and is easily built.—KT

Profits by Experience

ANSWER TO *KT's* trouble is continuous blowdown and chemical treatment. There was a time when I was skeptical about this, but now I'm a firm believer. Our product is sugar and we occasionally get sirup in the condensate, which forms 65% of our feed. This produces a very acid condition, even to the extent of foaming and priming. Condition sometimes occurs suddenly and we can cure it quickly with continuous blowdown and chemical treatment. Lengthy blowdown on main valve doesn't help at all.

If *KT's* boilers have good circulation he should seriously consider a continuous blowdown system. Cost is reasonable and it really does a fine job besides permitting an accurate check on quantity blown down.

Our system consists of an internal pipe in steam drum a little under minimum water level, a ½-in. line running to a small feed heater, a discharge to the sewer and a bypass to an oil drum for measuring flow. Flow is controlled by a stainless-steel orifice installed in union on ½-in. line and a bypass around the orifice. Good stainless-steel-trimmed valve is used in bypass. Each line has shutoff valve so a single boiler may be connected to oil drum to check flow. Photos show details.

Our boiler pressure is 460 psi, backpressure on heater 20 psi. Orifice disks are ⅛ in. thick with a 1/16-in. hole. Blowdown is kept under 2% with monthly checks. Present disks have been in use over a year. We find the holes partly plug about monthly but we can clean them out in about 10 min.

G C LEWIS *Vancouver, B.C.*

More Plant Problems, page 132

An Important Message for the Power Plant Field!

How to Get the Most Value for Your Water Conditioning Dollar!

INVESTIGATE INFILCO EQUIPMENT

The money you spend for a Water Conditioning Plant is a dividend paying investment only when you get equipment which fits your specific needs and which affords satisfactory service—year in, and year out. INFILCO gives you more than just tanks, pipes and a means of effecting chemical reactions. Back of each installation is the knowledge gained from over 55 years of water conditioning research. Behind each installation is the "know how" that means *the right equipment for the particular task.* Infilco offers a complete range of treatment equipment, which permits a selection tailored to the need.

Year after year, Infilco Equipment stands the test of time. The extra value of sturdy construction and realistic ratings pays off in more trouble-free, long service life. Investigate, today, the value you get from Infilco Water Conditioning Equipment. Call in the nearest Infilco Field Engineer. He's only a phone call away. There's no obligation, of course—only the obligation to yourself to investigate why Infilco Equipment is a good buy.

A WIDE RANGE OF INFILCO WATER CONDITIONING EQUIPMENT SERVES THE POWER NEEDS OF MANY INDUSTRIES

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Pharmaceutical Plant, Pennsylvania	*Hot Process Accelator*
Chemical Plant, Kentucky	*Hot Process Accelator + Hot Process Zeolite Softener*
Central Station, Illinois	*Demineralization + Silica Removal Equipment*
Steel Mill, Penn.	*Accelator + Zeolite Softener*
Industrial Power Plant, Mississippi	*Accelator + Hydrogen Cotexor®*
Chemical Plant, Texas	*Demineralization Equipment*
Pigment Plant, Missouri	*Accelator + Two Stage Hot Process Accelator*
Brewery, Wisconsin	*Combined Sodium-Hydrogen Zeolite (Controlled Exchange)*

Send for...

New Bulletin No. 1855. It gives interesting facts and pictures on boiler feedwater treatment and the Hot Process Accelator.

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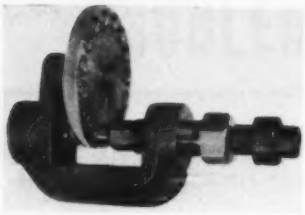
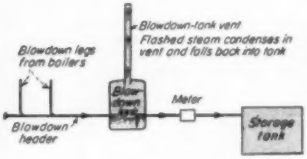


Purchased Valve

PHOTO SHOWS a valve we bought for continuous blowdown service. Wheel has 15 orifices for various flow rates. Blowoff is found directly in pounds per hour. We haven't used intermittent manual blowdown since installing one of these valves on a boiler.

D T KELLAND *New York, N. Y.*



Metering Best

KT's FLOWMETER NOZZLES were improperly located. That's why he didn't have any luck with them. With boiler pressure on one side and atmospheric on other, excessive velocities caused rapid wear.

Run all blowdown lines to a vented tank where pressure equals atmospheric. Flashing will occur in tank. Install meter on blowdown-tank discharge line; measure as in sketch. If blowdown-tank vent is sufficiently long, flashed steam condenses before leaving "stack." With these conditions there'll be little loss.

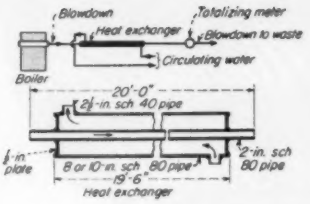
A M PALMER *Brooklyn, N. Y.*

Weighing Will Work

SINCE *KT* has tried weighing he probably still has equipment in plant. Use this if boiler pressure is closely regulated. Blowdown is always at saturation temperature corresponding to absolute pressure in drum.

Take sample in open barrel and let vapor flash off. Water temperature after flash will be 212 F. Correct observed weight by application of a factor that takes into consideration properties of flashing mixtures. Factor can be found in many books dealing with boiler blowdown.

R DIJULIO *Chicago, Ill.*



Build Heat Exchanger

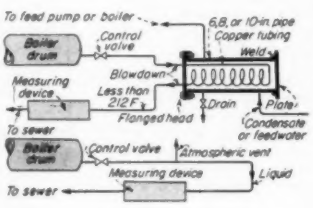
SIMPLE HEAT EXCHANGER in sketch can be easily and cheaply fabricated in any shop. Dial-type meter is available for reading in pounds per hour or gallons per minute. A 1-in. meter would probably be suitable.

A J BREUGELMANS *Hoboken, N. J.*

Several Suggestions

IT'S POSSIBLE to approximate blowdown quantity by subtracting steam output from feedwater supply when these quantities are metered. But chance for error is large. I don't believe *KT's* method of marking drum gage glasses would be accurate in normal operation.

Chemical analysis method of continuous blowdown measurement is widely used. See manufacturer's handbooks for



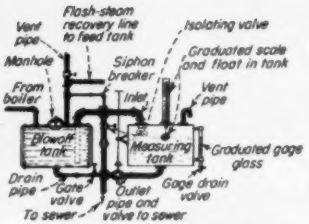
details on blowdown and chemical analysis.

I recommend *KT* install heat exchanger to reduce blowdown temperature below 212 F. He can heat feedwater in exchanger and make blowdown measurements at temperature below that of flashing. Run blowdown over calibrated weir, into barrels or through a stainless-steel orifice to find quantity. Sketch shows heat-exchanger setup. Exchanger will recover much heat from blowdown.

Water heated in exchanger should be oil-free condensate or feedwater.

Alternate method, also shown in sketch, lets portion of flow flash, and measures liquid with barrel, orifice, nozzle or other device. Flash percentage is figured from steam properties by methods given in many books.

C A GIESE *New Martinsville, W. Va.*

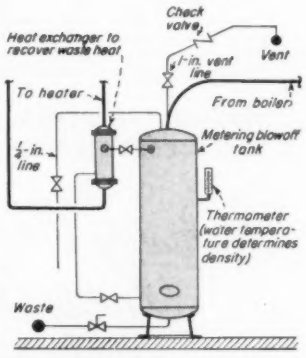


Measuring Tank Works

OBTAIN A MEASURING TANK that holds 10% more than maximum blowdown. Square or rectangular tank is preferable to a circular one because graduation is easier. Measuring-tank fittings are shown in sketch. Measuring device is either a water gage glass graduated in inches or a scale mounted on tank top. Scale height equals that of tank. Graduate in gallons on one side of pointer and inches on other, corresponding to tank. Graduation marks can be made large so they are easily read from a distance.

When boilers are blown down, water in blowoff tank from previous blow is displaced. Blowdown cools while it's in this tank. To take care of evaporation a line is piped from blowoff-tank vent pipe and connected to a feed tank. Put valve in vent pipe on atmosphere side of recovery line to feed tank. Flashed steam that normally goes to atmosphere is conducted to feed tank by recovery line where it condenses. It can be reused.

J A WEEKS *Sydney, N.S.*



Three Methods

SEVERAL FIRMS BUILD continuous blowdown systems with heat recovery and metering. Heat recovery alone pays for system, not counting advantage of concentration control and labor saving. Most homemade systems are eventually scrapped and replaced with a factory-

(*Continued on page* 168)

On Ship or Shore, draw on this fund of Anaconda Condenser Tube experience

The condenser installations at the Harbor Steam Plant, Department of Water and Power, Los Angeles, using 272,000 pounds of ANACONDA Super-Nickel Alloy 702 Tubes (70-30 Cupro-Nickel), are typical of American Brass Company technical service.

For 20 years American Brass Technical Department engineers have been studying the growing pollution of cooling water from Los Angeles Harbor—and its corrosion and wear of condenser tubes. Case histories of many installations operating under parallel conditions clearly indicated the use of ANACONDA Super-Nickel Tubes.

But today the pollution of Los Angeles Harbor is beginning to be cleared. Tomorrow a different alloy may be expected to do the job. Then, American Brass Technical Department engineers will document their new recommendations with studies of the new conditions . . . with convincing performance records of the ANACONDA Condenser Tube Alloy that best meets those conditions.

These performance checks of ANACONDA Condenser Tube installations—both marine and stationary—have built experience for which there is no substitute. That experience is yours simply for the asking. Just write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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A Los Angeles Harbor Station condenser containing over 10,100 ANACONDA Super-Nickel 702 Tubes (70-30 Cupro-Nickel) ⅞ in. O.D. by 26 ft., 3 in. long.

For efficient heat transfer ANACONDA® CONDENSER TUBES

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENTS HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

ELECTRICITY: Preventive Maintenance of Electric Overhead Cranes • Low Inertia DC Motors for Rolling-Mill Drives • Requirements for a Modern Steel-Mill Distribution System • Grounding Practice of the Inland Steel Co

GAS TURBINES: Control of Gas Turbines for Power Generation

WATER TREATMENT: Dianodic Method to Prevent Pitting, Tuberculation • Sampling of Steam to Determine Purity • Economic Analysis of Condensate Corrosion-Control Methods

POWER TRANSMISSION: Some Aspects of Selecting and Applying Gears for Rolling-Mill Equipment

BUILDING STRUCTURE: Design of Protective Structures — A New Concept of Structural Behavior

OILS AND LUBRICANTS: What to Look for in Hydraulic Fluids • Graphite as a Lubricant • Extreme-Pressure Lubricants • Transformer Oils in the Steel Plant

SMOKE CONTROL: Dust, Fume and Smoke Suppression

Directions for ordering papers are given on page 152

Electricity

PREVENTIVE MAINTENANCE OF ELECTRIC OVERHEAD CRANES, *by H C Mullings, Jones & Laughlin Steel Corp, Pittsburgh, Pa.* It is becoming a matter of common knowledge that a preventive-maintenance program consists essentially of having available the necessary parts and trained manpower to make anticipated repairs with minimum production loss and minimum cost. But an adequate preventive-maintenance program starts with the proper cooperation between the various engineering and operating departments in an effort to incorporate adequate features of design, engineering and construction in cranes and runways.

After installing necessary crane facilities, an adequate inspection routine must be religiously followed. Crane operating personnel and supervision must also be trained in proper operation of the cranes to provide a well-integrated program.

Since the use of overhead cranes is so finely interwoven in almost every phase of steel-plant operation, these various features of an adequate preventive-maintenance program as summarized constitute the type of preventive-maintenance program toward which we should strive. This is especially true in these times of constantly increasing costs when repair time and down time are expensive.

This paper presents some of the various factors that are essential in formulating an adequate preventive-maintenance program. *AISE paper. No number.*

LOW-INERTIA DC MOTORS FOR ROLLING-MILL DRIVES, *by J Henry Schneider, Elliott Co, Ridgway, Pa.* Low-inertia dc motors have low inertia as compared to dc motors with normal proportions.

They are used when short acceleration and deceleration time are required. Most mills that handle metal strip in coils require quick accleration and deceleration to reduce amount of offgage material and to increase production. Highest-speed mills require the lowest-inertia motors.

Low inertia is obtained by using a smaller-diameter armature with a much longer core. Weight remains about the same but the radius of gyration is decreased. Commutation, ventilation and mechanical considerations determine minimum diameter for a given rating. Separate pressure ventilation is needed to cool the machines. These long-core small-diameter machines cost more to manufacture than normal motors.

The inertia can be made still lower by using two, three or four low-inertia motors to supply the total power required by the mill or reels. These may be arranged as twin drives, tandem drives. Two, three or four motors are more expensive than one large motor of the same total horsepower.

Sometimes it is possible to reduce the accelerating time by using lower-speed motors. These slower motors may have more WK^2 but will have less stored energy because of rotation and hence will be easier to start and stop. *AISE paper. No number.*

REQUIREMENTS FOR A MODERN STEEL-MILL DISTRIBUTION SYSTEM, *by F H Wickline, National Tube Co, Lorain, Ohio.* The paper uses the new Lorain 60-cycle distribution system as an example in establishing the requirements for an adequate steel-mill distribution system. This type of system must be planned for load growth and system flexibility over an extremely-long life span.

To provide this flexibility and the optimum of service continuity, careful thought has to be given to future needs, and to the economic balance between capital investment and production loss.

Physically, the system must provide a maximum of protection from lightning phenomena and mill ducts, maximum personnel safety and minimum land-surface interference.

Distribution voltage should be as high as possible, but should not exceed design range of the large ac drives to be served. Neither should it exceed the maximum design voltage of compact indoor metalclad switchgear, so switchyard space and expensive high-voltage switching equipment may not be required at the receiving end of the lines.

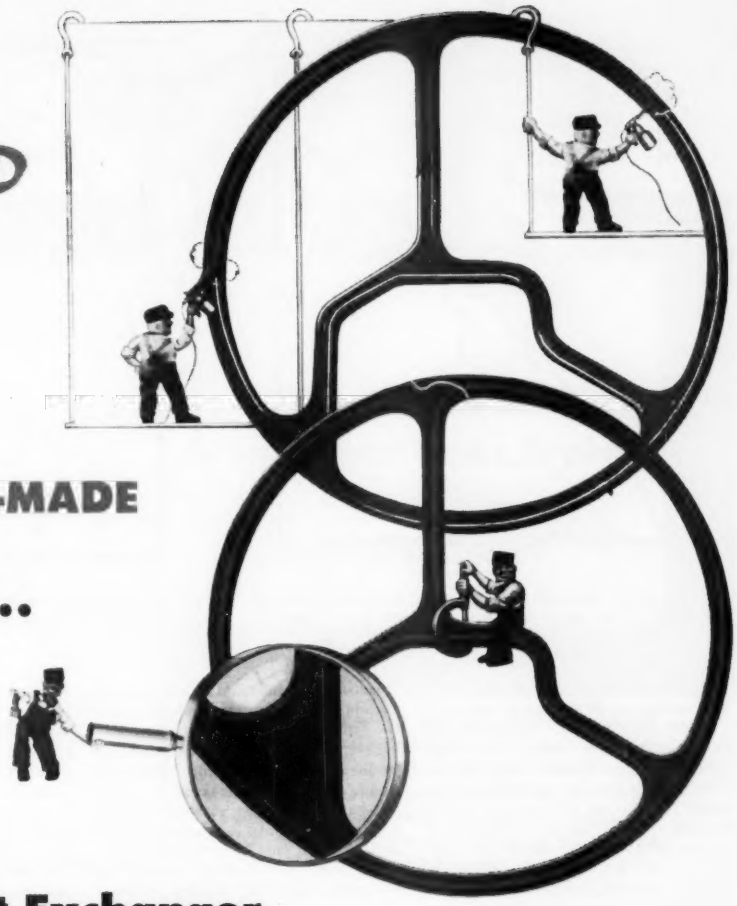
Underground cable systems at 13.8 kv meet more of these requirements than any other system, so such a system serves the new Lorain mills. The underground duct banks were formed by pre-cast concrete spacers and fiber ducts, poured in pea-gravel concrete. Prefabricated modular form sections were used for forming, resulting in a substantial saving for formwork. Cable was type-H sectored 15-kv paper insulated lead-covered cable, with 25-kv potheads.

Because of building obstructions one section of aerial open-wire line had to be installed. Note that during the months the system has been in operation, the only line failures have been on this open-wire section, indicating the superiority of underground cables over open-wire lines for mill-distribution systems. *AISE paper. No number.*

GROUNDING PRACTICE OF THE INLAND STEEL CO, *by V E Schlossberg, Inland Steel Co, East Chicago, Ind.* Reference in this paper is made to the National Electric Code, Article 250, and steps or moves taken at the Inland Steel Co to make their power system as near lightning proof as possible.

The writer deals with the initial ground; grounding of all equipment including auxiliary equipment, lightning,

PAINTED
to resist rust...



PRECISION-MADE
to resist blowouts...

...this Heat Exchanger Gasket will stay on the job longer

The durable coating of red paint on every Goetze iron or steel-jacketed Style 923 Heat Exchanger Gasket is a sure "stop light" against rust. And rust, as every metal gasket user knows, is a primary cause of deterioration—both in the storehouse and on the job awaiting installation.

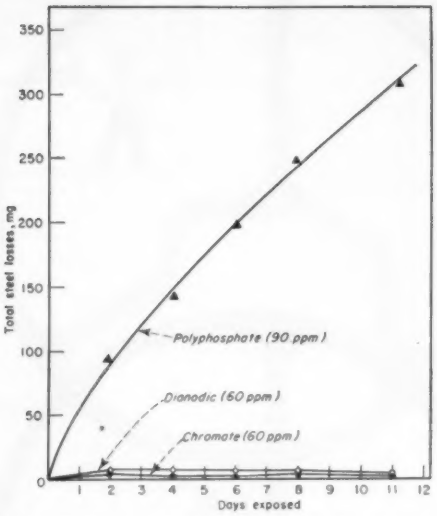
Equally important in the fabrication of Style 923 is the precision craftsmanship which eliminates cracks and wrinkles in the metal jacket—defects which can rapidly lead to leaks and blowouts.

"Custom tailoring" accounts for the meticulous care which is taken in the forming of every one of these gaskets... care which results in a long, efficient service life. You can always depend on a Goetze Style 923 to fit and seal perfectly... to stay on the job without leaks or blowouts. And that, of course, pays off in less down time and fewer gasket replacements.

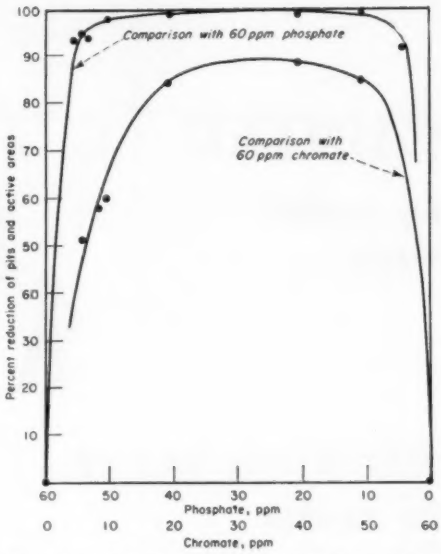
Find out how little it costs to have Goetze Heat Exchanger Gaskets "tailored" to the size and shape *you* need. For prompt estimates and recommendations, write Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville *Goetze* GASKETS

THERE'S A JOHNS-MANVILLE PACKING AND GASKET FOR EVERY SERVICE.



1 Test results indicate dianodic water treatment, properly applied, gives good, effective protection against pitting


Percent reduction of pits and active areas
Comparison with 60 ppm phosphate
Comparison with 60 ppm chromate
Phosphate, ppm
Chromate, ppm

2 The two anodic treatments, chromate and phosphate, used together, appear to act as single agency against pitting

office equipment, portable equipment and equipment in hazardous locations.

When the electrical equipment was first installed there was some trouble with lightning. Putting lightning arresters at the base of each motor eliminated troubles on the original 2300-v 25-cycle system. These are also installed on the 6600-v system, which was later used on the hot-strip mill. When capacitors as well as lightning arresters became the recommended practice these were also installed. A ground wire was also put in over the feeders and this effectively prevented lightning trouble when the ground wire was grounded at each tower. Grounds are sunk in such a way that the ground resistance is less than two ohms. By following the measures described in the paper as well as practices recommended by the National Electric Code, the grounding practice has reduced markedly disturbances in the electrical system, according to the author. *AISE paper. No number.*

Gas Turbines

CONTROL OF GAS TURBINES FOR POWER GENERATION, *by D C Hoffmann, A G Mellor, N E Starkey, General Electric Co.* Development of the gas turbine as a new prime mover for power generation has required the parallel development of suitable controls. At present these controls provide for semi-automatic starting and stopping, speed and load control, protection of the unit under abnormal operating conditions or in the failure of any component part.

Several gas-turbine characteristics made its control different from other prime movers. For instance, it is not self-starting. It does not even become self-sustaining until it reaches at least 50% of rated speed. So a means must be furnished for cranking the unit up to firing speed and helping promote acceleration after firing takes place.

Further, temperature control has to be established to limit maximum and rate of change of turbine inlet temperature so the turbine will not be damaged. Turbines, normally running on bunker-C oil, must be started on diesel oil and transferred to bunker C at or above idle speed.

The authors describe the main components in control of General Electric gas turbines and how these components combine to perform the required functions. An interesting table shows various component trouble experiences and the nature of the trouble in the different cases. *AIEE paper No. 50-269.*

Water Treatment

DIANODIC METHOD FOR PREVENTION OF PITTING AND TUBERCULATION, *by H. Lewis Kahler, Charles George, WH & LD Betz, Philadelphia, Pa.* Dianodic is a convenient expression to identify a specific combination of two anodic inhibitors (phosphate and chromate) in proper ratio at a controlled pH to prevent pitting and tuberculation. The term avoids confusing this method with the conventional use of chromate and phosphate to prevent corrosion and scale.

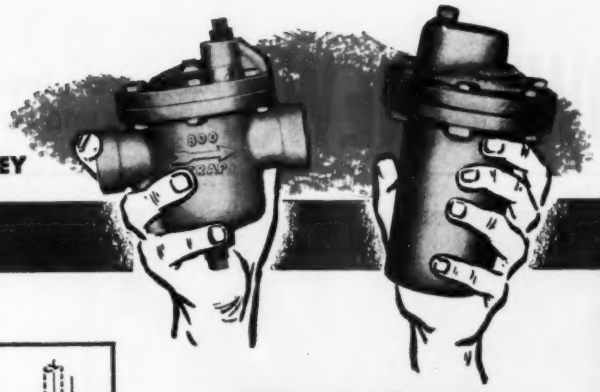
The authors feel this is a new approach in corrosion control. It eliminates typical pitting and tuberculation that single chromate and single phosphate treatments cause when used in insufficient concentrations. From experimental evidence it appears that these two anodic treatments, phosphate and chromate, used together are not acting as two separate treatments, but as a single agency to eliminate objectionable pitting, tuberculation, Fig. 2.

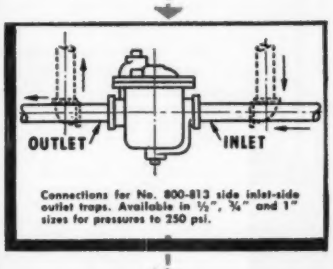
The dianodic method effectively equals the protection chromate alone provides and is far superior to phosphate alone, Fig. 1. Quantitative pit data are presented in specially surfaced corrosion specimens accompanied by tuberculation data on pipe nipple threads. Plant results, in recirculating cooling-water systems, so far indicate complete agreement with the experimental data, according to the authors. *ESWP paper. No number.*

SAMPLING OF STEAM FOR DETERMINATION OF PURITY, *by B J Cross, Combustion Engineering-Superheater, Inc.* The term *steam purity* in its literal interpretation refers to all substances in steam other than water vapor. Steam

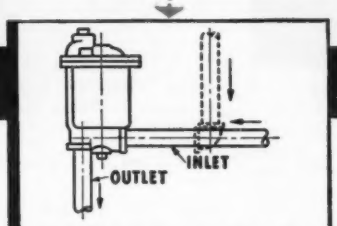
For more briefs, turn to page 152

YOU SAVE
TIME AND MONEY

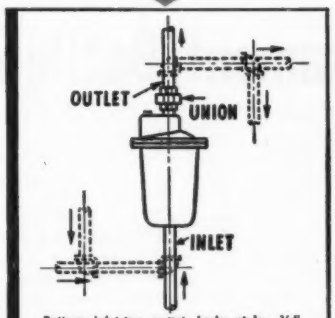




Connections for No. 800-813 side inlet-side outlet traps. Available in ½", ¾" and 1" sizes for pressures to 250 psi.



Side inlet-bottom outlet trap, ½" or ¾". Greatly simplifies connections to many types of small steam-consuming units.



Bottom inlet-top outlet body style. ½" through 2" connections. Cast semi-steel bodies for pressures to 250 psi. Forged steel bodies for pressures to 1500 psi.

"This choice of Steam Trap Body Styles simplifies installations"

IN THE most widely used sizes, Armstrong Steam Traps are available in either side inlet-side outlet or bottom inlet-top outlet body styles. This gives the user an opportunity to make exceptionally neat installations with a minimum of fittings and a minimum of labor and permits correct location of the trap in relation to the unit being drained.

In both styles the entire interior mechanism may be taken out for inspection or repair simply by removing the cap. The body, full of boiling water, is left in the line. In the case of the side inlet trap the cap may be removed without even disturbing the pipe connections.

Ask your nearby Armstrong representative to show you the opportunities for simplifying trap installations.

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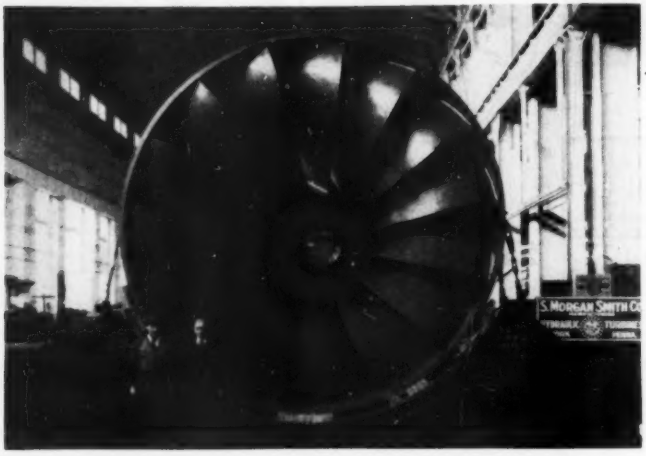
THE 36-PAGE ARMSTRONG STEAM TRAP BOOK gives data and prices on the complete line of Armstrong steam traps for every pressure, every application. This book is a valuable reference for the calculation of condensate loads and the selection of traps for all classes of equipment. Send for free copy today

ARMSTRONG STEAM TRAPS

POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS



Dennison Dam Plant Installs New Unit

On the Red River near the Oklahoma and Texas border, the U. S. Corps of Engineers has built Dennison Dam hydroelectric plant for flood control and power generation. The dam, an earth-fill design, is 23,200 ft long, 165 ft high and forms a reservoir of 6,000,000 acre-ft capacity. The plant will have 282,080 hp installed in five 56,000-hp main and two 1040-hp service units. Two main units built by S Morgan Smith Co have francis runners that are among the largest in the world, cast in one piece. They are 192 in. in diameter, weigh 157,600 lb and operate at 90 rpm under 130- to 75-ft head.

COMING EVENTS

Jan 15-18—Plant Maintenance Show, Municipal Auditorium, Cleveland, O. Held in conjunction with Plant Maintenance Conference, L C Morrow, chairman, Factory Management & Maintenance, New York 18.

Jan 22-26—International Heating and Ventilating Exposition, Commercial Museum, Philadelphia, Pa. 57th annual meeting. Charles F Roth, mgr, International Exposition Co, 480 Lexington Ave, New York, N. Y.

Jan 22-26—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York, N. Y. E C Day, Secy, AIEE, 33 W 39th St, New York 18, N. Y.

Mar 5-9—American Society for Testing Materials. Spring meeting and committee week, Cincinnati, Ohio. ASTM, 1916 Race St, Philadelphia, Pa.

March 13-16—National Assn of Corrosion Engineers, Conference and exhibition, Hotel Statler, New York, N. Y. L B Donovan, chairman, Consolidated Edison Co, 4 Irving Place, New York, N. Y.

April 2-5—American Society of Mechanical Engineers. Spring meeting, Hotel Atlanta-Biltmore, Atlanta, Ga. O B Schier, ASME, 29 W 39th St, New York 18, N. Y.

European Power: Rearmament Bottleneck

McGraw-Hill World News, *Paris*: A major offensive is about to be launched against the tightest bottleneck in the Western European rearmament picture —the electric-power shortage.

The objective is a boost in effective power output of 7 to 8% in two years. Organization for European Economic Cooperation will head up the drive and its keynote is to be close international cooperation.

As OEEC sees the job the drive should be three pronged: (1) a push for maximum interconnection across frontiers (2) establishment of a system for financing international power exchanges (3) program to expand existing hydroelectric plants.

Increasing the scope and efficiency of power interconnections is held crucial to the efficiency of Western Europe's power system as a whole. A study of various peak loads and their occurrence indicates considerable room for improvement by sharing neighboring countries' surplus-power capacity at the moment of peaking.

Interconnection will greatly increase total energy output and do it at much less cost than any other method possible. In Western Europe it is particularly helpful because of the high proportion of hydroelectric power generated there. Hydro output varies according to season. Regions in the south and north of Western Europe build up good water surpluses during spring and summer. These surpluses are not drawn on within the local power networks. France, in fact, let a lot of water spill over its reservoirs in 1950 because it had more than it could store. Yet neighboring countries were hard put to meet power demands. A simple interconnection would have worked out to everyone's advantage.

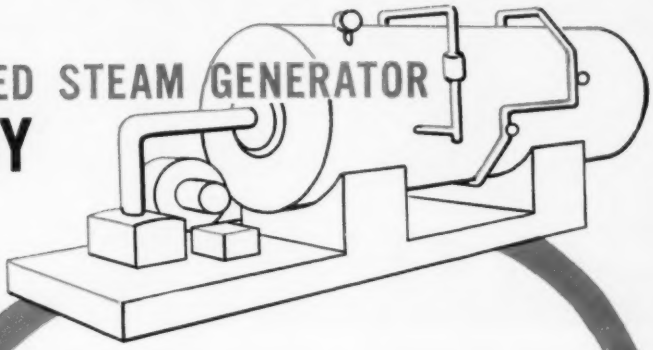
Second objective of smoother financing is aimed at cutting through some of the tangled payments problems involved in transmitting power across postwar European boundaries. Trade experts are figuring out what the effect would be of treating power as a commodity rather than including it in the invisible trade account.

(*Continued on page* 212)

CREDIT IS DUE General Electric Co for the excellent photographs illustrating the Arc Welding article on pp 111, 112, POWER, December 1950.

Ideal Combination

FOR TOP SELF-CONTAINED STEAM GENERATOR EFFICIENCY



1

Nalco WATER TREATMENT

SCALE AND CORROSION PREVENTION

With a Nalco Service Policy and Nalco Chemicals to fit your water treatment requirements, you can keep your self-contained boilers operating indefinitely at top efficiency — without any of the costly difficulties caused by scale and corrosion. This part of the Nalco System was designed expressly to provide small boiler users with the same complete water treatment services enjoyed by thousands of the country's largest power plants. A new 4-page bulletin gives complete details on The Nalco System as applied to the modern self-contained boiler. Your copy will be sent promptly, without obligation.

Write for Bulletin 49

2

Nalco SR-155 FUEL OIL ADDITIVE

FUEL SAVING . . . CLEAN BURNERS

Nalco SR-155 is a *complete* fuel oil additive. It replaces two, three or more single-purpose additives to: (1) keep storage tanks, fuel lines and burners free of sludge and gum; (2) prevent soot formation in the firebox and flues; (3) inhibit corrosion throughout the fuel system; and (4) act as a combustion catalyst to assure complete burning of oil. Fuel savings and reduced maintenance costs usually more than repay the cost of continuous SR-155 treatment — and very little SR-155 is needed per 1,000 gallons of fuel oil! Details on Nalco SR-155 will be sent on request.

Write for Bulletin 46

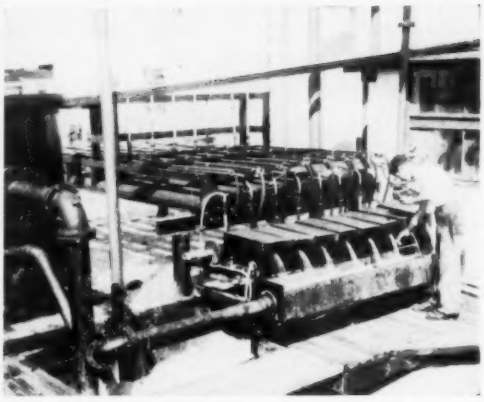
NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM • Serving Industry through Practical Applied Science

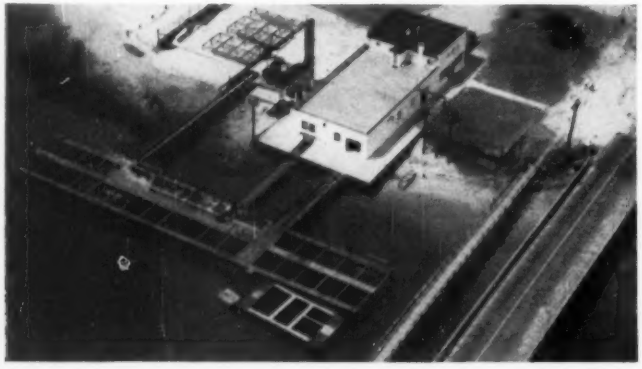
OUT OF OCEAN TEST TUBE, monel specimens show typical marine growth. All pilings of dock area also serve as test specimens



CHLORINE TREATMENTS of varying strength are tested in this setup for effectiveness on marine growths, corrosive action

Ocean Put Into Another 'Test Tube'

New Harbor Island Station increases facilities, widens scope of unique Kure Beach cooperative corrosion-testing project



NEW TEST TUBE is at Wrightsville Beach, near Wilmington, N. C. All salt-water testing is now at Harbor Island; Kure Beach still has the atmospheric test stands

► BACK ABOUT 17 YEARS an International Nickel Co corrosion specialist thought the intake flume of Dow Chemical Co's ethyl-bromine plant at Kure Beach, N. C. would be a good place to hang some test specimens. Dow agreed. The man was Frank L. LaQue, and the project started in this informal and cooperative fashion has become world-famous as a corrosion-testing center.

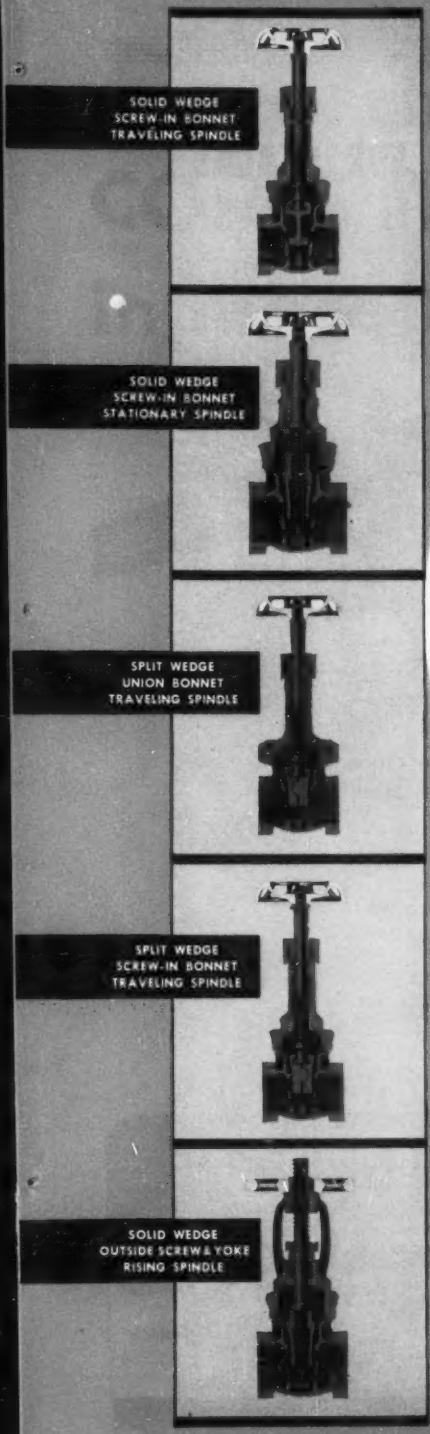
The original idea of comparing corrosion resistance of low-alloy steels with carbon steel soon widened to include all kinds of ferrous and nonferrous metals and alloys. In 1940, facilities for exposing specimens to atmospheric attack were added. Now, some 20,000 specimens are on racks in two locations—about 80 ft from the ocean, where spray can reach, and about 800 ft inland.

When the bromine plant shut down in 1945, immersion testing was moved to the plant's inlet basin and the former pump house was used for laboratory work and accelerated testing of various kinds. (See POWER, Sept 1949, pp 105-8; Aug 1947, pp 90, 91.) When storm damage to the basin finally made a change necessary, the Harbor Island site (some 15 miles from Kure Beach) was chosen because it offered a protected inlet. Here new facilities for immersion testing and laboratory work were built and many specimens moved from Kure Beach to the new site. All atmospheric testing continues at Kure Beach.

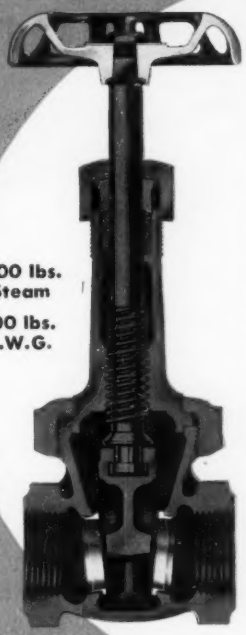
As before, most specimens are exposed on racks continuously immersed at a depth of 3 to 4 ft. Some hang from a pontoon float to maintain a constant water line. All piles in the dock area serve as tests also. In all, some 2500 specimens are now exposed to sea water. In the station, basic studies are made and many forms of accelerated tests are carried out.

Typical of special test work is the chlorination setup pictured above. In identical parallel pipe circuits flows sea water chlorinated to various resid-

(*Continued on page* 166)



Specify JENKINS for your Best Buy in Bronze Gates



200 lbs. Steam

400 lbs. O.W.G.

JENKINS FIG. 270-U

Solid Bronze Wedge

and FIG. 270-UN

Nickel Alloy Wedge

Traveling Spindle — Union Bonnet

BRONZE GATES

Monel and Bronze Seating Combination Adds Years of Extra Service Life

In Fig. 270-U, a high quality bronze wedge seats against MONEL rings expanded in the body. With this sensible design, the wear affects only the most accessible part—the bronze wedge—which can be easily replaced by slipping a new one on the stem when necessary. Records in every type of service prove it an excellent combination for lasting economy.

Fig. 270-UN, with a nickel alloy wedge, is recommended for exceptionally severe conditions of rapid wear and corrosion.

The Gates For Your Toughest Services

Made in sizes from ¼" to 2", Fig. 270-U or Fig. 270-UN will provide unequalled economy in any 200 lb. steam, 400 lb. O.W.G. service. Compare performance, especially where conditions are most destructive to valves, as in oil refineries, dye houses, chemical, rubber, and food plants. You'll find there are no other valves like them.

Whatever your need in Bronze Gates, you'll find the right valve for the service in Jenkins complete line. Thirty-five different patterns are available for steam pressures up to 300 lbs., O.W.G. pressures up to 600 lbs. All are built to Jenkins unvarying high standard which makes them the longest-lasting, lowest-upkeep valves that money can buy. Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors.

WRITE FOR THIS FOLDER
Form 181-B It describes the Fig. 270-U and other popular Jenkins Bronze Gates or, ask your Jenkins Distributor.

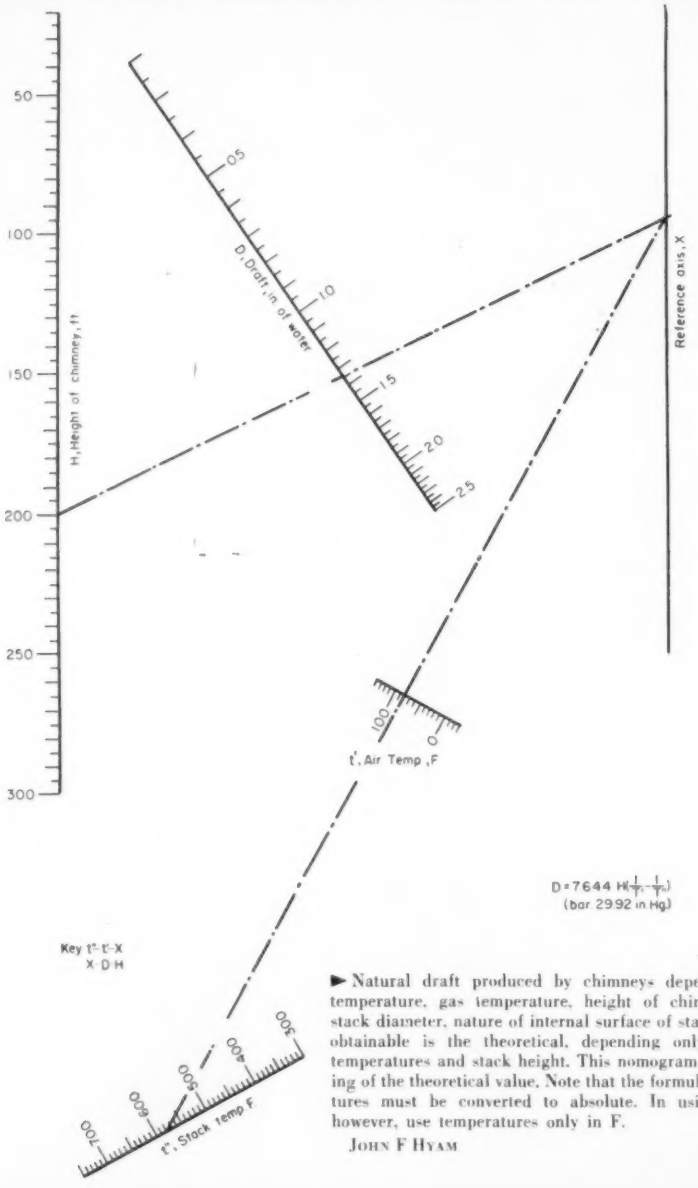
JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Number 223

THEORETICAL NATURAL DRAFT FOR STACKS



► Natural draft produced by chimneys depends on outside-air temperature, gas temperature, height of chimney, gas velocity, stack diameter, nature of internal surface of stack. Maximum draft obtainable is the theoretical, depending only on air and gas temperatures and stack height. This nomogram allows quick figuring of the theoretical value. Note that the formula specifies temperatures must be converted to absolute. In using the nomogram, however, use temperatures only in F.

JOHN F HYAM *Sarnia, Ontario*

more than 3800 COPES Multi-Element Regulators in more than 1300 plants

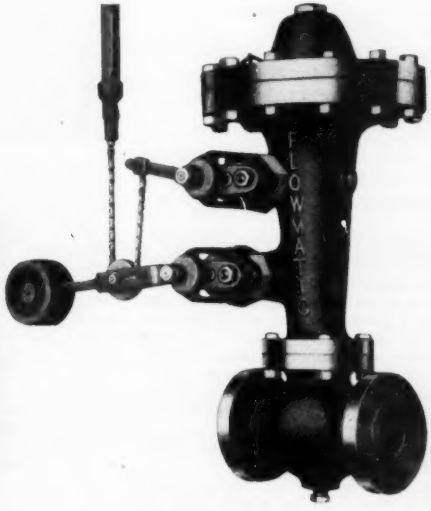
LOOK at the record. More than 1300 plants depend on COPES Multi-Element Regulators for accurate feed-flow and water-level control on their fast-steaming high-duty boilers. Some use the COPES Balanced Flow, actuated by steam flow, feed flow and water level. Others use COPES Flowmatic, the most widely used two element regulator. Let this wide experience help you operate your boilers more safely, more efficiently. May we show you how?

NORTHERN EQUIPMENT DIVISION
Continental Foundry & Machine Company
111 GROVE DRIVE **ERIE, PENNSYLVANIA**

COPES

Headquarters for . . .

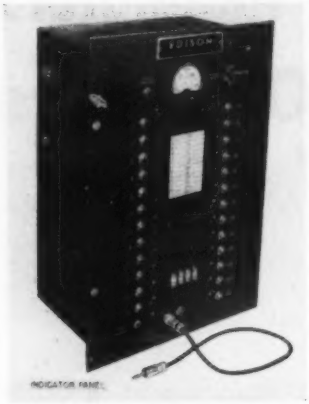
Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.



PLANT EQUIPMENT NEWS

Published monthly as a service to readers

Your information center for new products to solve plant problems. Spot what you need, use handy cards p 192a, to get more details

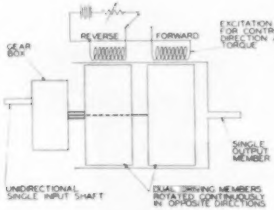


TEMPERATURE MONITOR P143

Dependable means for automatic temperature supervision at remote and inaccessible locations in machinery, spaces and liquids. Single panel allows fast checking of up to 25 potential danger spots and areas. Instantaneous alarm and accurate temperature readings.

Sensing elements are resistance bulbs of various types and ranges. Monitor is suitable for supervision of bearing temperatures in power-generating stations, rolling mills, railway rolling stock, etc.

Thomas A Edison Inc, Instrument Div, West Orange, N. J.



MAGNETIC-PARTICLE CLUTCH IS NOW REVERSIBLE P137

Reversing *Magneclutch* has two driving members and but one driven member. Fed from a gearbox, the two driving members are the input to the two magnetic-particle clutches; they rotate continuously in opposite directions. By energizing the proper excitation coils in the clutch mechanism, rotation direction of the output shaft is determined

Vickers Electric Div, Vickers Inc, 1815 Locust St, St. Louis 3, Mo.

DC MOTORS FITTED WITH PRELUBRICATED BEARINGS P133

Proven-design features in the ac *Life-Line* motor have now been adapted to type SK dc motor. They include the rolled-steel frame and protection to any degree required from dripproof to dripproof-protected and totally enclosed.

As with all prelubricated bearings, ball bearings in this series are packed with proper amount and type grease that lasts for the bearing's life. No additional lubrication is needed.

Molded *Melamine* rocker ring holds and insulates the rods supporting the brushholders. This new insulating material has high dielectric strength and does not carbonize when current passes over its surface. Hence if a ground should occur from dirt or carbon, maintenance men merely wipe the dirt off and the rocker ring's insulation is restored.

Additional long-life features were incorporated in field coils, brushholders and armature.

Westinghouse Electric Corp, 306 Fourh Ave, Pittsburgh 30, Pa.

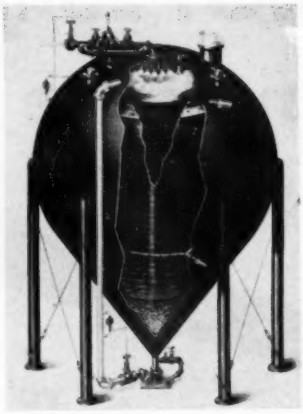
CAR SHAKER P122

Lightweight 1250-lb car shaker unloads 50-ton hopper-bottom railroad car in 4 to 7 min. Unit moves equally well with coal, sand, crushed stone, cement. Vibration is produced by a motor-powered cam-shaking mechanism.

A steel bar clamps the shaker to the car. One end of bar hooks into the underframe of the hopper car. The other fastens to the screw of the shaker.

Shaker may be furnished with either a wheel cart, a jib crane or an overhead mono-rail for mounting the shaker to the car. One man is needed to attach unit.

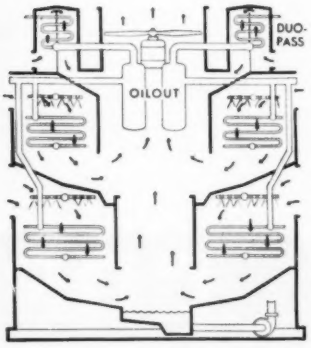
National Conveyor & Supply Co, 346 N. Harding Ave, Chicago 24, Ill.



WATER SOFTENER P126

New-design sedimentation tank, *Spheri-cone*, has hemisphere mounted on a cone. The raw-water, steam and chemical inlets, spray headers, deaerator and treated-water collector are all mounted in the hemisphere. The inverted cone contains the downtake, sludge bed and rising zone of water being treated.

Graver Water Conditioning Co, 216 W 14th St, New York 11, N.Y.

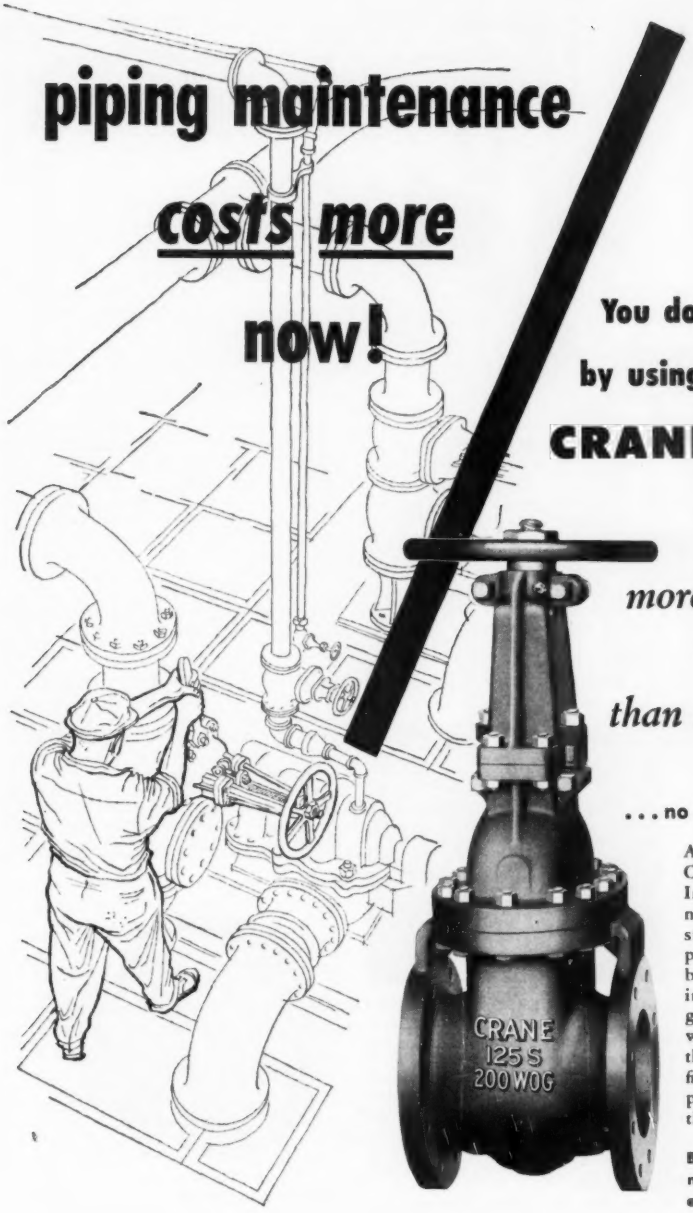


REFRIGERANT CONDENSERS P105

High-capacity units serve large refrigeration plants. Nominal rating is 300 tons. Recommended application is to plants above 400-ton capacity so operator may obtain economy that mulitple-unit installation gives by varying condensing capacity with actual refrigeration load. Dimensions: length 14 ft, width 13 ft, height 18 ft;

For further data on above items use reply cards on page 192a, identifying your request with letter P and number

piping maintenance costs more now!



You do less of it

by using Dependable Quality

CRANE VALVES

That's why more Crane Valves are used than any other make

. . . no bonnet trouble with this valve

A typical example of low-maintenance Crane Quality—No. 465½ 125-Pound Iron Body Gates. Rarely does the bonnet joint need attention. Flange construction includes reinforcement to prevent distortion and utilizes more bolts, more closely spaced than is usual in valves of this class. Crane precision-guided seating reduces seat and disc wear. Packing has long life because these valves have a deep stuffing box filled with high grade asbestos ring packing. A ball-type gland equalizes the packing load.

Better performance features like these make Crane the better buy in valves of every type. Ask your Crane Representative for a demonstration.

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

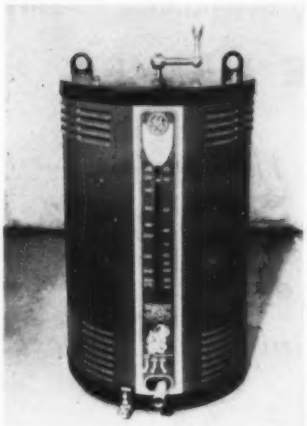
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

EQUIPMENT NEWS *CONTINUED*

weight is about 20 tons, and largest section weighs about 4 tons.

Refrigerant gas first passes through precooling coils on top of structure. These remove superheat and reduce gas temperature close to condensing point. Coils also condense entrained oil vapors which are removed by *Oilout* separators. Gas then passes to condensing coils where it condenses by evaporation of a strong water spray. Condenser saves water.

Niagara Blower Co, 405 Lexington Ave, New York, N.Y.



PORTABLE WELDER P119

Silicone-insulated, portable, ac welder, the 6WK30J series, is water repellent and unaffected by high temperatures as a result of this insulation. *Hot-Start* automatic control gives instant arc striking without any manual adjustment. This welder averages less than one lb per amp of maximum output; weighs 325 lb and has a current range from 40 to 375 amp.

General Electric Co, 1 River Road, Schenectady 5, N.Y.

FLEXIBLE CONDUIT P144

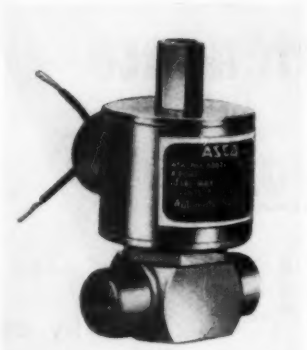
Sealtite is flexible, liquid-tight conduit to protect electrical wiring from water, oil, chemicals, etc. It is designed for installation where movements are small or infrequent.

The American Brass Co, Waterbury 20, Conn.

WIRE MARKERS P146

Quik-Label colored wire markers are of silicone-treated cotton cloth with adhesive backing. They stick permanently to wire without moistening. Markers come in 14 standard NEMA colors.

W H Brady Co, 16 East Spring St, Chippewa Falls, Wis.



PACKLESS SOLENOID VALVES P102

Two- and three-way *Midget Size* packless solenoid valves for severe and frequent service. They handle wide range of liquids and gases up to 212 F. Valves are suited for assembly in equipment needing compact, durable and efficient automatic control, such as oil burners, gas heaters, measuring and testing apparatus. They can be mounted in any position. Pipe sizes of 2-way valves are ¼ and ⅜ in. (normally closed) and ⅛ in. (normally open). Pressures range up to 300 psi for ac, and to 250 psi for dc. Pipe size of 3-way valve is ⅛ in. only, with pressures up to 125 psi for ac and to 50 psi for dc.

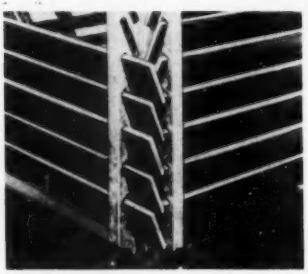
Automatic Switch Co, 379-C Lakeside Ave, Orange, N.J.

OPEN-GEAR GREASE P140

Tenacious and absorptive, Keystone Grease No. 32 is supplied in cartridge form to fit a special nozzle gun applicator that ribbons the grease. This feature often means grease can be applied while gears are moving.

No. 32 is water repellent, its melting point is over 400 F and it retains plasticity with temperatures below freezing. There is also a grease suitable for subzero application.

Keystone Lubricating Co, 21 St & Lippincott St, Philadelphia 32, Pa.



COOLING TOWER P124

Atmospheric-spray cooling tower, *Type H*, for small packaged air-conditioning and refrigeration condensing units, is mass-produced in 10 frame sizes with capacities for refrigerating loads from 3 to 35 tons. Tower assembly is simplified. Newly designed corner posts bolt easily and rigidly to pan sides; slip-fit louvers, redwood or galvanized steel, slide into place through machine slots.

Binks Mfg Co, Water Cooling Div, 3114-40 Carroll Ave, Chicago 12, Ill.

METALCLAD SWITCHGEAR P148

Indoor, air-magnetic circuit breakers in metalclads now come in interrupting ratings of 50, 150 and 250 mva. Service voltages range between 2.3 and 4.16 kv.

Allis-Chalmers Mfg Co, 952 S. 70 St, Milwaukee, Wis.

TEMPERATURE INDICATOR P125

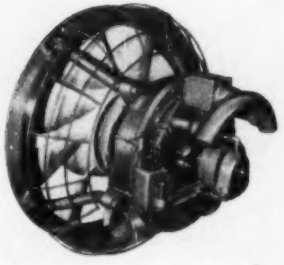
Thermocouple-actuated temperature indicator, the *Microsen*, combines advantages of full-scale circular dial, power-driven pointer and *Microsen* balance. Adjustable calibrating resistor is part of the thermocouple circuit. Further, a replaceable reference junction permits calibration change to other thermocouple materials.

Manning, Maxwell & Moore, Inc, Bridgeport 2, Conn.

STEAM-JET CLEANER P106

Smaller, all-electric *Steam-Jet* cleaner, JC-20 16 in. wide by 40 in. long, has built-in high-pressure *Speedylectric* boiler, Model 600-3, that enables it to use steam along with solvents for cleaning service. Rated at 20 kw, unit consumes about 15 kw per hr under ordinary operation.

Livingstone Engrg Co, 100 Grove St, Worcester 5, Mass.



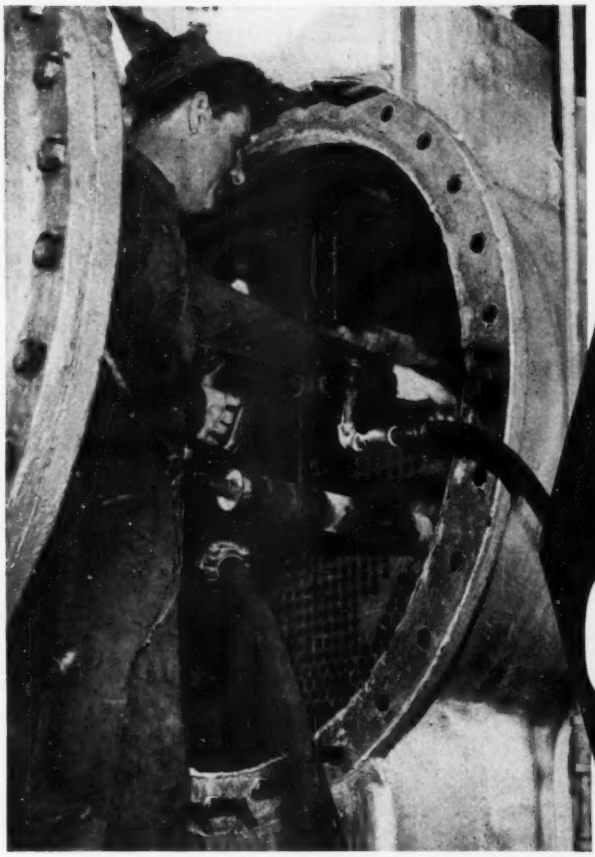
TURBINE BLOWER P121

All steel, streamlined turbine blower, for steam conditions up to 600 psig and 750 F, requires no water cooling of bearings. For oil-burner applications the blower can be bolted directly to the windbox without additional support. Unit carries capacities up to 70,000 cfm or static pressures up to 20 in. wg.

L J Wing Mfg Co, Linden, N.J.

(*Continued on page* 148)

For further data on above items use reply cards on page 192a, identifying your request with letter *P* and number



Condenser Tubes must be... KEPT CLEAN

Newport shoots the brushes through the tubes with an air-water gun at 75 lbs. per sq. in. They come from the far end like projectiles. Another Revere contribution was to assist in the design of a target to stop the brushes without damage.

● Condenser tubes almost immediately acquire a film that protects the metal from corrosion. Such film is thin, and beneficial. If it does not form, the probability is that the wrong alloy has been selected. It is part of Revere's service to collaborate with you in selecting the alloy that will be most economical in the long run.

There is another and much heavier type of formation within a tube that impairs its operation, or shortens its life, or both. This is the deposition of foreign matter such as shells, which may cause erosion-corrosion effects, and the growth of organisms such as algae. The latter materially reduce heat transfer.

Take the case of the Newport Electric Corporation, Newport, R.I. Its condensers are cooled by harbor water, with the result that algae and other marine organisms coat the tubes, reducing efficiency, lowering the vacuum, and increasing fuel consumption.

This utility is exceptionally well managed, with a systematic tube-cleaning program. However, it found that brushes and rubber plugs used for cleaning wore out quickly. Revere took a close interest in this problem. One of Revere's customers makes nylon brushes for cleaning tubes in dairies, and it was suggested that a modification of these be tried. Results: over 300 tubes cleaned per brush, a much longer life than anything previously used, and a half-inch gain in vacuum, meaning dollars and cents saved in fuel.

Revere makes condenser tubes and plates in all the usual alloys, and is glad to collaborate not only in specification, but in other condenser problems, as this case history shows. We are only too glad to work with you on any matter involving condenser and heat exchanger operation. Our wide experience, and contacts with many industries will be made freely available to you. Write the nearest Revere office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

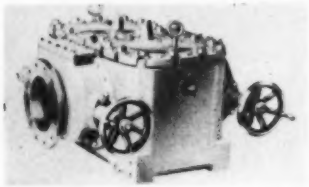
EQUIPMENT NEWS *CONTINUED*

OUTDOOR CT **P138**

Type KO current transformer can be mounted in any position, is well suited for metering and heavy-duty relay application. Both primary leads are brought out to blade-type terminals through a single porcelain bushing.

CT's are available in standard ratings up to and including 800 amp and through voltage classes 5, 8.7 and 15 kv.

Allis-Chalmers Mfg Co, 952 S. 70 Street, Milwaukee, Wis.

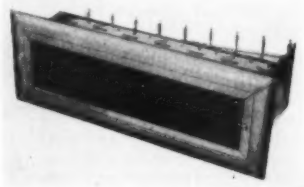


DUPLEX STRAINERS **P101**

Angle design applied to multiple-catch baskets permits straight-through flow with low pressure drop and high flow rates in gate-type duplex strainers. When baskets are 90% blocked, pressure drop, measured with water at room temperature, increases 44%. Units, in 8, 10, 12, 14, 16, 20 and 24 in. sizes, handle flow rates from 400 to 15,000 gpm.

Strainers are fitted with hinged-top covers and multiple baskets to allow one man to clean them. Baskets are designed for retention of strained particles during removal for cleaning. Furnished for right- or left-hand operation and with chain drives to operate inlet and outlet valves simultaneously. Flow is continuous. Another optional feature is a bypass valve, recommended when high fluid pressures cause difficult hand-wheel operation.

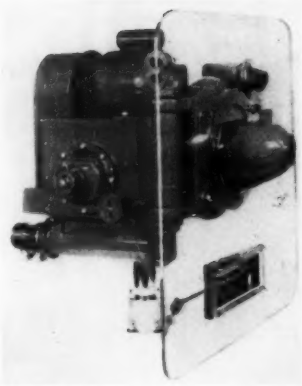
J A Zurn Mfg Co, Erie, Pa.



AIR GRILLE **P120**

Combined grille, volume-control and deflecting vane makes possible a cut-down of duct take-offs to give an over-all reduction in air-conditioning distribution systems. Air-deflecting vanes produce uniform flow across the grille face. Volume-control adjuster makes it possible to balance a system readily. Yet it is hidden so it remains in effect tamperproof.

Barber-Colman Co, Rockford, Ill.

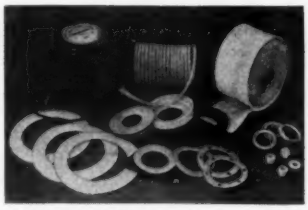


OIL BURNER **P110**

Horizontal, rotary-cup atomizing burner recently announced in ratings of 9, 16, 25, 35, 50 and 60 gph is equipped with manufacturer's *Volumeter*. This allows use of all grades of oil up to No. 6 with varying viscosities without adjustment.

Burner has a gear-type circulating pump running at constant speed to maintain a constant oil supply in a reservoir. Reservoir provides a head of oil over the metering pump submerged in the reservoir.

Iron Fireman Mfg Co, 1305 S W 12th Ave, Portland 1, Ore.



VALVE PACKING **P114**

Chemically inert, heat-resistant, tough, durable packings and gaskets can be had with *Teflon*. This material operates at temperatures from below –90 F to 500 F with high mechanical strength and low coefficient of friction.

Garlock Packing Co, Palmyra, N.Y.

HEAT EXCHANGERS **P112**

Shell and tube bundle heat exchanger, the *A-800*, has been developed for oil cooling in diesel locomotives or engines, gasoline engines or similar applications. Bonnets provide smooth inlet and outlet flow with minimum impact on headers.

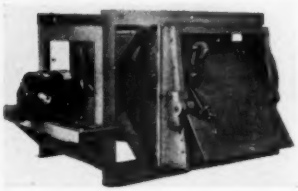
Young Radiator Co, Racine, Wis.

POTENTIAL TRANSFORMER **P136**

Design changes in single- and two-bushing transformers have reduced weights up to 60% in some ratings. Finished product is hermetically sealed, hence free from breathing. This feature lengthens life of insulating oil since oil is protected from oxidation.

Units are available in the 500-va, 60-cycle, oil-filled class, in 24-, 34.5-, 46-, and 69-kv ratings.

Allis-Chalmers Mfg Co, 952 S. 70 St, Milwaukee, Wis.



DRAFT INDUCER **P107**

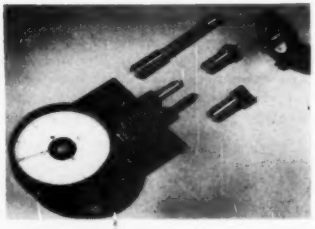
More precise control of furnace draft can be had by a variable-speed motor equipped with integral barometric dampers. Damper has a hinged explosion gate to relieve any excessive pressures developing in the breeching.

L J Wing Mfg Co, Linden, N. J.

HIGH-PRESSURE GASKET **P128**

Compression gage-type gasket, with both inside and outside ring, has spiral-wound construction with alternating V-crimped plies of metal and filler. For all practical purposes the inside ring converts one of a pair of smooth-face flanges to a groove flange providing all the safety of a wholly contained gasket without the expense of machining a flange.

Flexitallic Gasket Co, 8th and Bailey St, Camden 2, N.J.



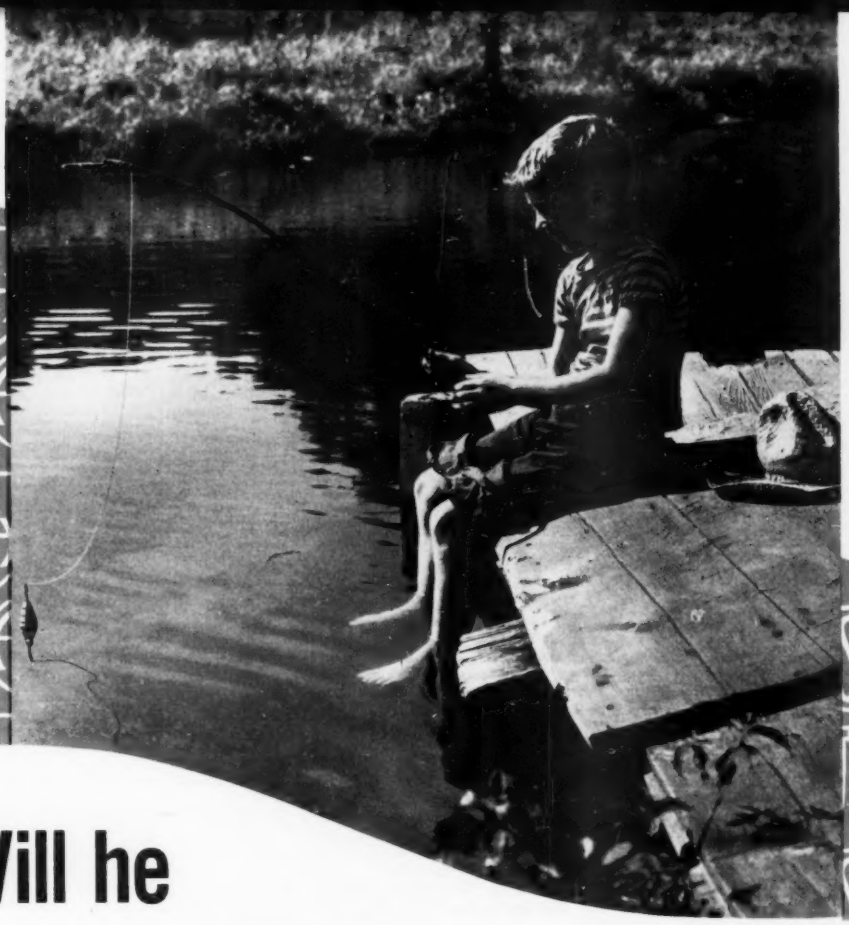
HAND TACHOMETER **P108**

Dual-range hand tachometer, *Smith's Model ATH 10*, features low torque, 0.40 in.-lb on lowest range. Ranges are 0 to 1000 rpm and 0 to 5000, each printed on the dial in a contrasting color. Instrument carries a knurled knob for range selection and a pushbutton on either side for releasing or holding pointer, or both, at machine-speed.

Equipoise Controls, Inc, 100 Stevens Ave, Mount Vernon, N.Y.

(Continued on page 150)

For further data on above items use reply cards on page 192a, identifying your request with letter P and number



Will he get a bite?

Soon there'll be thousands of kids like this all over America, anxiously waiting for the first bite of the season. They don't often make record catches, but they get a big thrill when the first minnow or sunfish grabs their hook.

Unfortunately, some of them won't even get a nibble, because upstream there are plants that still use outdated ash disposal methods. Besides spoiling the fishing, they make the water unfit, not only for public use, but for the needs of other industries.

Today many streams are running clear again, because the modern Recirculating Hydrojet System makes it possible to handle any daily ash tonnage hydraulically—without stream pollution. The flow of ashes and water is completely self-contained, and the ashes are made commercially dry for unloading into trucks or railroad cars. Since only enough moisture remains to prevent dust escape, a minimum of make-up water is required. Our engineers will be glad to tell you how the system can be applied to new or existing installations.

HYDROJET ash handling system

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*

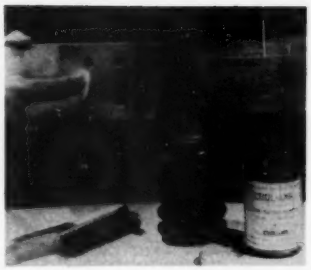
EQUIPMENT NEWS *CONTINUED*

SILVER-PLATING POWDER P145

For plating high-current connections on the job. Only equipment needed is an abrasive cloth, rag and water.

Cool-Amp Silver-Plating Powder deposits a coat of silver that will not peel off and gives maximum conductivity for copper, brass or bronze contacts. Powder retails at $11.50 for 1-lb bottle.

Cool-Amp Co, 8603 S W 17th Ave, Portland, Ore.



PACKAGED BOILER P129

New, versatile addition to packaged steam-generator line can burn gas, light oil, heavy oil or a combination of gas and oil. In pressures from 15 to 200 psi, it comes fully equipped with integral burner, automatic safety and operating controls, valves and other equipment to make unit complete.

Cyclotherm Corp, Oswego, N.Y.

For more data on these items, use post cards, p192a. Identify request with *P* and number.

DUST COLLECTOR P130

Tubular dust collector permits refiring high-carbon particles back into the fire without recirculating all the flyash. Separation of the high-carbon particles takes place within a single unit with one pass of the furnace gas. The method, known as *P-D Decantation*, employs two hoppers, one to collect high-carbon particles the other to dispose of low-carbon particles.

Thermix Corp, Greenwich, Conn.

HEAT EXCHANGER P116

Corrosion-resistant materials used only where required—as flange inserts, and for the inner tube contacting the fluid or vapor being heated—produces a low-cost heat exchanger, the *Econalloy*. This heat exchanger can be supported horizontally or vertically along a wall or on hangers. Unit comes in sizes from fraction of a sq ft of heating surface to several hundred and in lengths up to 30 ft per segment. Tube sizes range from ¼ to 4 in. for pressures up to 900 psi and temperatures of about 700 F.

Martin-Quaid Co, 1893 Sedgley Ave, Philadelphia 32, Pa.

STEAM CLEANER P123

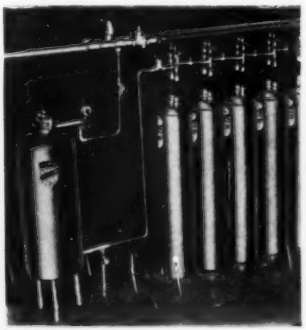
Fully automatic, one-man operation is claimed for the General, a vapor steam cleaner. Steam issuing from the heating coils has a metered quantity of cleaning compound already dissolved in a hot-water bath fed into it. Mixture emerges as a jet from a cleaning-gun attachment.

General Equip Div, Sterod Mfg Co, 444 Frelinghuysen Ave, Newark 5, N.J.

CONCRETE SAWS P117

Three portable concrete saws, two gasoline-powered and one electric motor-driven, have cutting speeds of 12 ft per min for asphalt; 5 ft per min, 1 inch deep, for limestone concrete. Maximum cut is 6½ in. deep. Three-point blade suspension eliminates blade binding.

Clipper Mfg Co, Concrete Saw Div, 2800 Warwick, Kansas City 8, Mo.



SOFT WATER P131

Standard softener units, 2000-gal capacity, 7-gal-per-min flow rate, can be connected to a header assembly to provide soft water for laundries, commercial institutions. Push button *Cal-Flo-Valvs*, brine maker, check valves, brine timer and brine-and-rinse flow-rate controller are standard.

Culligan Soft Water Service, Northbrook, Ill.

Thumb Back a Few Pages And Check These, Too . . .

Variable-Speed Unit is based on tandem belt design; 1-15 hp; variations to 16-1 ..... page 182

Dust Collector that takes air or gas and passes it at high velocity over a louvered surface. Because of the cone-shaped form, dust particles are pushed away from the cone face. Then clean air leaves through slots; dust goes to outlet end of cone ..... page 182

Manual Motor Starter has bimetallic overload protection plus an indicating light that shows when motor feed is complete ..... page 184

Compressed-Air Separator uses centrifugal force to clean air. Seven inlet and outlet sizes from ½ to 2½ in ..... page 186

Long-Scale Instruments having 250-deg scale, 14.2 in. long ..... page 190

And Next Month . . .

Electronic Hygrometer for measuring and controlling industrial and commercial conditioning. The element makes use of gold leaf and a chemical salt solution that eliminates cleaning and other maintenance

VIBRATION ISOLATOR P103

Adaptable to many types of machinery and equipment *Finnflex* Type 9 vibration isolator consists of a steel channel floated in rubber between two steel angles. Because spring index is not constant, resonance is avoided. Isolators come in lengths up to 18 in. in four rubber stiffnesses for loads of 40, 50, 70 and 105 lb per in. of length at ¼-in. deflection.

Finn & Co, 2850 Eighth Ave, New York 30, N.Y.

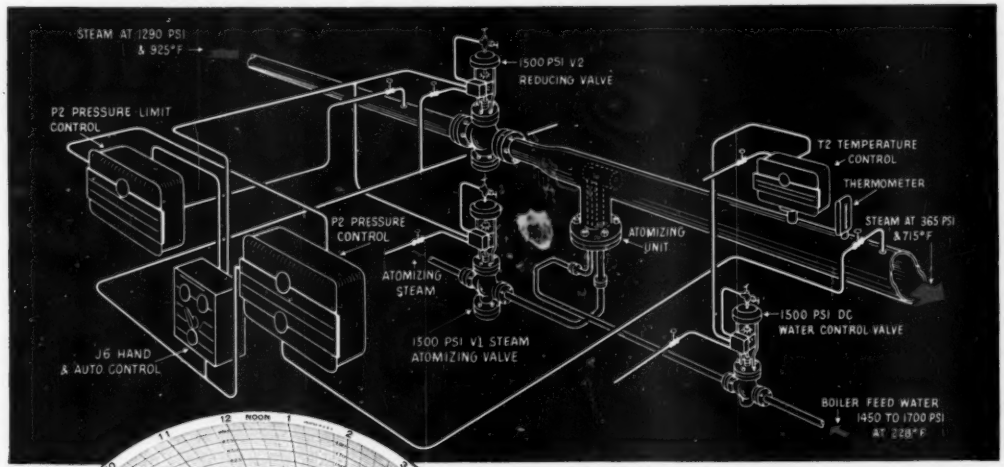
SOCKET WRENCH P115

Five standard-size socket-head wrenches fold knifelike into a single sturdy handle. The assembly, called *Smitty*, is small enough to fit into the pocket. Individual wrenches are high-quality, tempered steel, easily replaced by removing the end bolt and sliding out.

H D Hunter Co, 1109 S Robertson, Los Angeles, Calif.

(*Continued on page* 182)

Swartwout RDC* controls within ±1 psi and ±3°F even with widely fluctuating load swings


STEAM AT 1290 PSI & 925°F
1500 PSI V2 REDUCING VALVE
P2 PRESSURE LIMIT CONTROL
T2 TEMPERATURE CONTROL
THERMOMETER
P2 PRESSURE CONTROL
ATOMIZING UNIT
STEAM AT 365 PSI & 715°F
ATOMIZING STEAM
1500 PSI DC WATER CONTROL VALVE
J6 HAND & AUTO CONTROL
1500 PSI V1 STEAM ATOMIZING VALVE
BOILER FEED WATER 1450 TO 1700 PSI AT 228°F

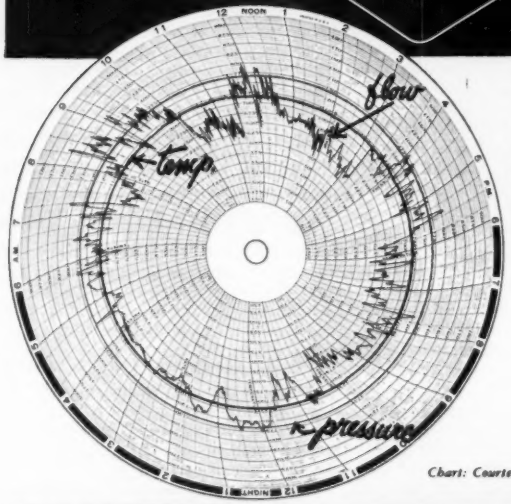
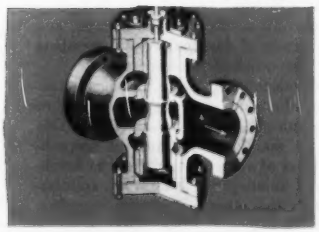


Chart: Courtesy Iowa Power and Light Company

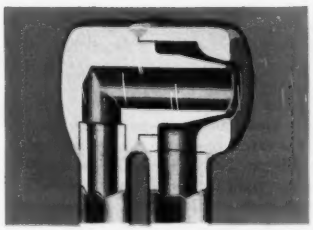
1 Chart shows how Swartwout RDC*– Reducing, Desuperheating and Control System – handles low-pressure turbine load of 65,000 to 165,000 lbs. steam per hour in Power Plant No. 2 of the Iowa Power and Light Company, Des Moines. It reduces from 1290 to 365 psi and desuperheats from 925° to 715°F. When main reducing valve closes extremely light loads can be handled by pressure reducing valve supplying atomizing steam. Operation of the system is stable regardless of load change or time lag.

Swartwout

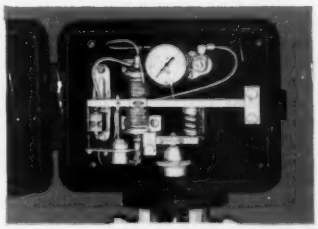
POWER PLANT EQUIPMENT



2 Swartwout V-2 Regulating Valve has smooth, nozzle-shaped passages which guide expansion of high-pressure steam to reduced pressure zone without high-velocity impingement or other destructive forces common to conventional valves. Undue noise, turbulence and vibration are eliminated; longer valve life results.



3 Swartwout Steam Atomizing Desuperheater, constructed of stainless steel, has accurately machined passages that give narrow-angle dispersion of cooling water outside of steam atomizing head. There is no impingement of steam or water against walls of unit, no erosion of parts, no need for pipe liners.



4 Swartwout T-2 Control, with metallic temperature element in steam pipe, gives rapid and precise control regardless of magnitude of load or time lag. There are no flapper valves, relays or other delicate elements. Only two simple adjustments are involved; one for temperature, one for response.

A-5098

SEND FOR BULLETINS S-21-E, S-22-C, S-198 • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

TECHNICAL BRIEFS Continued from page 136

is defined as the commercial product, rather than the pure substance, *water vapor*, described in steam tables.

As generally accepted, steam purity refers to the solid impurities or those substances that remain as solids in the residue after a sample is evaporated to dryness. The customary unit of steam purity is parts per million of the impurity. So steam impurity would be much more appropriate.

Samples of steam for measuring purity may be taken before or after the superheater. But fouling of superheater elements is of as much importance as deposition and turbine blading so most frequently the sample is taken ahead of the superheater.

Problems of drawing a representative sample from a large mass whose flow is not necessarily homogeneous are numerous and difficult. Several engineering societies have tried to set up standard sampling pipes or tubes. Among the leaders are ASME and ASTM. Their studies have gone a long way toward bringing more light on what is yet far from a precise measuring gage. *ESWP paper. No number.*

AN ECONOMIC ANALYSIS OF CONDENSATE CORROSION-CONTROL METHODS, *by T B Kneen and R R Kountz, Pennsylvania State College.* Corrosion of condensate-return lines and condensing equipment has long been an expensive maintenance item in steam-generating stations. The mechanics of this corrosion is understood as the attack of ferrous and cuprous alloys by carbonic acid. Carbonic acid forms when carbon dioxide from the boiler (carried with dry steam) dissolves in the condensate.

Carbon dioxide results from decomposition of carbonates and bicarbonates in the boiler increasing in rate of formation with rise in temperature and pressure. Some small amounts of carbon dioxide get in with makeup.

Three ways to check corrosive action of the carbonic acid are: (1) replacing usual metals with acid-resistant alloys or stainless steels (2) preventing carbon dioxide's presence in steam (3) neutralizing or retarding the effect of carbonic acid.

The authors discuss each method and then work up cost comparisons for a typical small steam-generating plant with an annual load of 145 million lb steam at 125 psig, using three 30,000-lb-per-hr units. *ESWP paper. No number. Available in proceedings.*

Power Transmission

SOME ASPECTS OF SELECTING AND APPLYING GEARS FOR ROLLING-MILL EQUIPMENT, *by Eduard C Denne, United Engineering and Foundry Co, Pittsburgh, Pa.* Factors influencing the selection and application of gears for rolling-mill equipment are not as intricate and mysterious as many believe. Too often only the supposed faulty gear is considered, without weighing many extraneous conditions that cause the trouble.

There is no such thing as an all-purpose gear. The many variables entering into the selection must first be recognized before the type and final gear details can be established for economical, satisfactory operation.

Many antiquated equipment installations operate today, some requiring constant maintenance. Besides the cost of frequent gear replacements, there is the costly production *down time*. This situation is not so frequent in standard reducers, or main mill drives since they are designed and built as units integrating most of the many variables. But at times competition and the resulting hair-line selections cause maintenance and production forces to constantly baby a drive.

When a drive is purchased on the price basis only, with no consideration of the extras built into the design, such as liberal bearings, shafts, gear elements, rigid housing, quality of machine work, cutting facilities, responsibility, etc, the buyer is accepting it on such a basis. It is the purchaser's responsibility to ascertain his needs, to specify them adequately and to assure himself that specifications have been met for a satisfactory job. This means the engineer will be the criticized person for not correctly advising his purchasing department.

All have had experience at some time with a set of gears that would actually wear out without performing useful service. Yet very little is done to ascertain the real cause. Much of today's gear trouble can be traced to using antiquated practices instead of improved design and manufacture. *AISE paper. No number.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources.

American Institute of Electrical Engineers, fall meeting, Skervin Hotel, Oklahoma City, Okla. Oct. 23-27, 1950. Identified by initials AIEE and obtainable through AIEE, 29 W 39th St, New York 18, N. Y.

Engineers' Society of Western Pennsylvania, Hotel Wm Penn, Pittsburgh. Oct 16-18, 1950. Identified by initials ESWP, and obtainable in proceedings from W M Porter, secy, ESWP, Hotel Wm Penn.

Association of Iron and Steel Engineers, annual meeting, Municipal Auditorium, Cleveland, Ohio. Sept 26-29, 1950. Identified by initials AISE and obtainable from T J Ess, managing director, AISE, 1010 Empire Bldg, Pittsburgh 22, Pa.

Building Structure

DESIGN OF PROTECTIVE STRUCTURES—A NEW CONCEPT OF STRUCTURAL BEHAVIOR, *by A Amirikian, Bureau of Yards and Docks, Navy Department, Washington, D.C.* Having survived the initial shock of implications related to the power of atomic weapons we can now give at least a qualified reply of assurance to the inevitable question, "Can we provide protection?" In reply, Amirikian declares that:

1. No complete or unqualified structural protection is feasible against the A-bomb as well as some conventional bombs.

2. Within the critical range of explosion all types of buildings will suffer damage varying in accordance with their proximity to ground zero.

3. In general the design criteria for protection against an atomic bomb of the presently known type are not as severe as required for some of the conventional weapons of the last war. Assuming the bomb is to explode at an altitude corresponding to its maximum range of damage the changes to be introduced in conventional designs of reinforced concrete for the needed protection will be relatively small.

4. By proper arrangement of framing and details, adequate over-all strength can be provided for a structure to avert collapse even though there may be severe local damage in large plastic deformations or failures.

5. With certain assumption of probable structural behavior the adequacy of over-all strength of the framing and the extent of damage to local members can be satisfactorily ascertained.

Statements regarding proof construction often convey wrong impressions of strength and structural adequacy. This is due mainly to improper or unqualified use of such stock phrases as bombproof, atomicproof, blastproof, splinterproof, and others of similar meaning. The designation of a building or a structure as protected against a weapon is meaningless without complete qualification of physical and ballistic properties as well as range and orientation of the weapon. Even with such qualifications no true appraisal can be made of the obtainable protection without a

(*Continued on page* 156)

ANNOUNCING A BRAND NEW CATALOG FOR BONNEY WELDOLETS

Contains complete and up-to-the-minute catalog information on all types of Weldolet welding fittings available. Presents a full range of sizes and schedules, introducing many new applications, together with simplified data on the determination of code requirements. To get your copy of this catalog, write . . .

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WELDOLETS

WELDING FITTINGS FOR ANY PIPING SERVICE

How to Live With TV

The other night on my way home from work I dropped in to borrow a catalog from a friend who's chief engineer of a large office building. His family were all seated at the dinner table, but guess where he was . . . perched on the edge of a chair in the living room, plate on one knee, cup of coffee on the other, staring at his television set.

Losing his grip? No, he's one of the smartest engineers I know. During the past two years he's changed over a large part of his building from dc to ac, air-conditioned nine whole floors, put electric controls on his old hydraulic elevators, and is now planning more air conditioning for installation this spring.

And, as you can guess, he didn't inherit the knowledge to do all these things well. It took lots of study—study that he's kept up most of his life.

But lately, like so many of us, he's had to devote less and less of his time to study—at a time when, with the growing responsibility he has in his job and the ever-increasing number of new engineering techniques he's got to know about, he should be devoting more and more time to study.

I face the same problem; many of you must, too. Working hours are shorter, less time to study on the job. The automobile, movies, radio and now the clincher of them all—television—make study in the evenings and on weekends a feat of great self-control and discipline. What can we do about it?

First, I'll stick my neck out and say we might as well realize that some of us won't spend as much time as we did in study . . . because we're only human beings. Very few are Horatio Algers. What we've got to do is make what studying we do count.

Like a lot of other engineers, I'm becoming more and more choosy about what I do read because it's the easiest thing in the world to turn on television or radio, or jump in the car and go some place—a lot easier than trying to wade through long-winded engineering dissertations.

When I buy an engineering book today, I'm mighty, mighty picky. I buy only those books I know will be easy to apply to my practical problems—handbooks that have tables set up in the units we use, textbooks with lots of drawings and charts, stuff that I know will be easy going. Same way with catalogs. I find myself using mostly those catalogs that make data easy to find, sizes easy to determine, etc.

And when it comes to the magazines, I read only those I know will get right down to brass tacks each month, and give me information I can put to use. Even then I read only those articles that look easy to read—short articles with the vital information condensed, and featured so I can get the meat without plowing through a lot of words. After I've read the captions, boxes, etc, maybe I'll read the article, but only if I need more information.

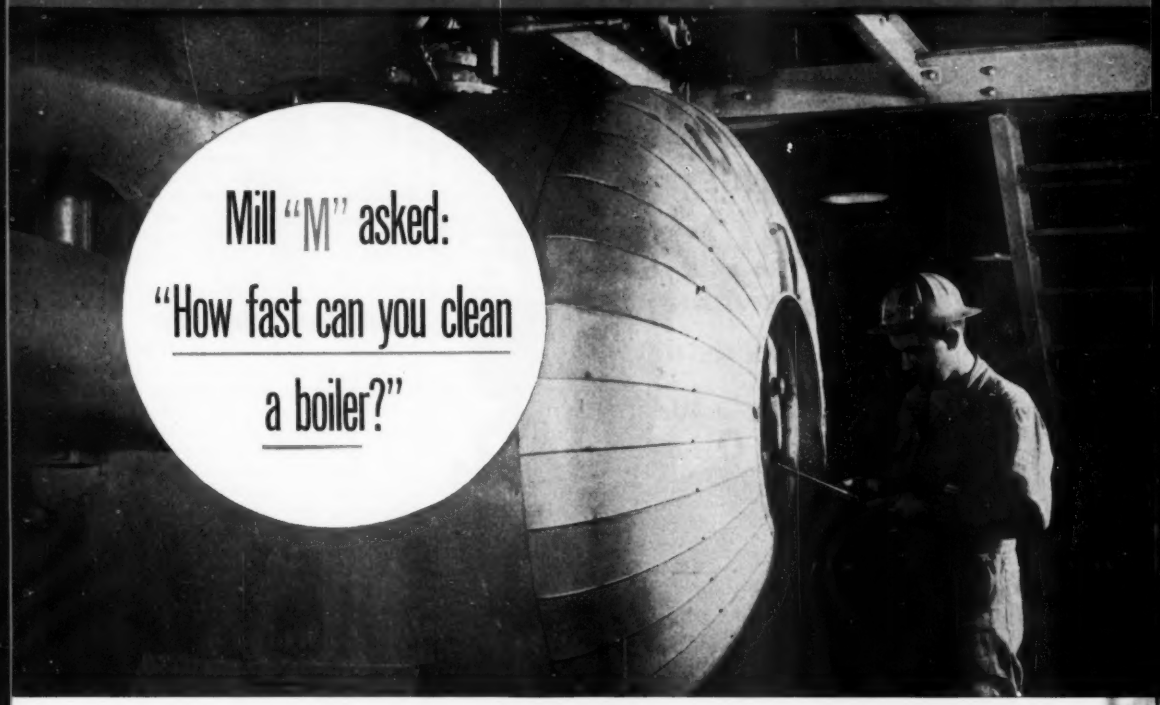
But I guess you get the idea. Study is mighty important to being a good engineer. Sure, we've got to keep up to date, or fall behind. But we like to play, too, and it's getting easier and easier to play.

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service cleaned the internal surfaces in 10 hours!

This was the case of a boiler generating 350,000 pounds of steam per hour with an operating pressure of 1250 p.s.i. In ten hours Dowell Service removed an estimated 1,000 lbs. of deposits which were causing tube failures. The boiler was back on the line the next day.

What is Dowell Service? It is simply the application of chemistry to the problem of removing deposits from heat exchangers, water lines and all kinds of process equipment. Dowell engineers fill the equipment with liquid solvents which reach wherever steam and water flow and are designed to dissolve and disintegrate the deposits efficiently and quickly. Dismantling is not necessary.

Somewhere in your plant there is a job that can be done *faster, better, more economically* by Dowell Service. Let an experienced Dowell Service Engineer help you with your maintenance planning. No obligation, of course.

Other recent Dowell jobs:

Entire Piping Systems **of two college dormitories cleaned of scale.**

•

Three Formaldehyde Contact Towers and Reboilers **cleaned and restored to designed operating efficiency.**

•

Six Black Liquor Evaporators **cleaned for paper company. Deposits removed from vapor and liquor sides in one operation.**

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Baltimore 18	Detroit 2	Houston 2	Salem, Illinois
Wilmington 99	Chicago 2	New Orleans 12	Borger, Texas
Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 69	Wichita Falls, Texas
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Long Beach, Oakland, Casper: Dowell Associate—International Cementers, Inc.

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ECONOMY

AT MODERATE INITIAL COST

100 TO 4000

HORSEPOWER RANGE

600# GA., 750° F.

STEAM PRESSURES

MURRAY

STEAM TURBINES

TYPE UV MULTISTAGE

The Type UV Multistage Turbine is available in from two to ten pressure stages making Multistage steam economy available at moderate initial cost. Horsepower range is from 100 to 4000, steam pressures up to 600# ga., 750° F., condensing or non-condensing. Several governors and accessories adapt UV Turbines to practically any mechanical drive within the capacity range.

Pictured is a 5 Stage UV Turbine developing 325 HP at 6200 RPM operating condensing. Turbine is equipped with variable speed oil relay governor, pressure lubrication and vacuum breaker, and is in use driving a centrifugal compressor for refrigeration.

Contact your Murray representative for prices and engineering information or write for Bulletin T-122.

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

TECHNICAL BRIEFS

(*Continued from page* 152)

change in our conventional concept and understanding of strength and resistance.

The author concludes that protective design, as a measure of defense, can only follow the progress of weapons of offense in a vicious circle of continued improvement. For what is devised now to be adequate against today's weapons is apt to be inadequate tomorrow. This sad reflection should have a sobering influence upon a false sense of security. *ASCE paper. No. 1950-486 F. ASCE, 29 W 39th St, New York 18, N. Y.*

Oils and Lubricants

WHAT TO LOOK FOR IN HYDRAULIC FLUIDS, *by Anthony J Zino, Jr, assistant sales manager, Industrial Div, Swan-Finch Oil Corp, New York, N. Y.* This is an original treatise on the application of petroleum oils—as hydraulic fluids—in industrial hydraulically-operated or -controlled equipment. It describes the physical properties of petroleum oils and their true importance in operating and maintaining hydraulic equipment. A direct comparison is made between the usual oil "specs" as written today by the hydraulic engineer or oil supplier, and the actual service performance characteristic or service properties required of the hydraulic fluid. Here are service properties listed in order of importance:

Usual Specifications

1. Gravity, API
2. Viscosity, SSU
3. Viscosity index
4. Flash point
5. Fire point
6. Neutralization No.
7. Carbon residue
8. Color, NPA
9. Pour point

Service Properties

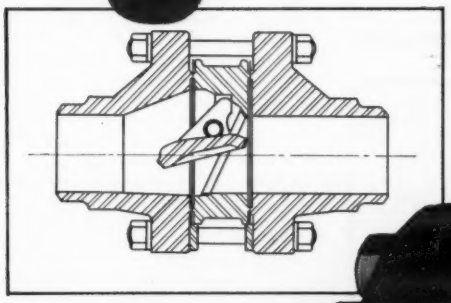
1. Viscosity
2. Viscosity index
3. Demulsibility
4. Oxidation stability
5. Lubricating value
6. Rust-, corrosion-preventive quality

A very comprehensive and illustrated description is given of each service property, its importance in hydraulic operation, method of evaluation, problems and their correction. *AISE paper. No number.*

GRAPHITE AS A LUBRICANT, *by E S Glauch, Joseph Dixon Crucible Co, Jersey City, N. J.* This paper deals primarily with graphite as a lubricant and its use in lubricants. Graphite is now used throughout industry for a multitude of purposes because of its many unique properties. It is unctuous, a quality that often causes "greasy" to be applied to it, although it contains no oil or grease. Graphite marks readily, burns slowly, and is almost

FOR HIGHER PRESSURES

3 Piece Tilting-Disc Check Valve



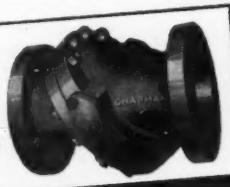
Has Removable Center Section for Quick and Easy Replacement of Operating Parts

Here's a Tilting-Disc Check Valve designed specifically for higher pressures. Its construction permits replacement of operating parts, if ever necessary, without removal of entire valve from the line. Once the studs between inlet and outlet sections of the body are taken out, the entire center section (containing disc, seating face and hinge pins) can be removed. Replacement of center section is fast, easy — an important advantage.

Important, too, is the smooth, easy operation obtained by the tilting-disc design. The balanced disc is held on the open stops by the velocity of the medium being handled. There's no slamming on closure to cause destructive pipe line stresses.

Write for complete description.

STANDARD 2-PIECE TILTING-DISC CHECK VALVES are available in either iron or steel for all pressures.



The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

When You Think of

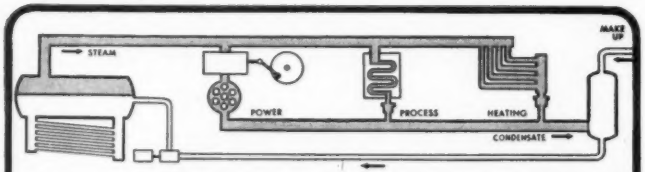
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS) ®

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special formulas of chemical treatment for: . . . boiler feed water . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

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STATE_____

chemically inert. It is also a good conductor of heat and electricity, has excellent weathering properties, and mixes readily and homogeneously when combined with oils or greases.

The paper refers briefly to information published in *Iron and Steel Engineer* some years ago, indicating power savings affected under actual steel-mill conditions where graphite lubricants replaced plain lubricants, previously considered satisfactory. *AISE paper. No number.*

EXTREME-PRESSURE LUBRICANTS, *by James H Lewis, Carnegie-Illinois Steel Corp, Clariton, Pa.* Describes extreme-pressure lubricants as applied to industrial equipment, and the importance of selecting the type of extreme-pressure lubricants procured, especially for general use. Advantage is given of using extreme-pressure oils on equipment where overloading may be occasional, even though manufacturer may recommend straight mineral oil.

Given also are advantages of using extreme-pressure gear shields on open gears including repair and maintenance savings in addition to quantities to maintain sufficient film of lubricant between gear teeth. Application of such lubricants is compared to conventional types of gear greases including safety factor desirable in industry. The savings realized by use of all types of extreme-pressure lubricants due to standardization, less inventory overhead and savings in processing orders for purchasing are covered. *AISE paper. No number.*

TRANSFORMER OILS IN THE STEEL PLANT, *by John F Boal, Carnegie-Illinois Steel Corp, Homestead, Pa.* Transformers are a vital part of the electrical concern of many steel-plant operators. One pending problem maintenance of insulating oil in transformers in a condition suitable for long trouble-free operation.

As a preventive-maintenance measure, various power companies and other industries, including some steel plants, have adopted a regular maintenance program for keeping transformer oil in good condition. A complete program should include periodic sampling and testing of used oil in each transformer, and reconditioning of oil by a suitable means, where tests indicate this is necessary. Various tests on used oils and their significance are discussed, together with various types of reconditioning equipment available. A well-kept record of the periodic tests made on each transformer is important.

A development of increasing interest to operators of transformers is the use of oxidation inhibitors, which may be added to the transformer oil to reduce

Ladish Reducing Elbows

PATENT PENDING

TO MARK PROGRESS

FLOW EFFICIENCY

Uniform, gradual reduction in diameter from face to face of the fitting, plus full, effective center-line radius reduces turbulence and assures maximum flow efficiency.

SEAMLESS DESIGN

The first practical Seamless Reducing Elbow, this Ladish development for which a patent is pending, is formed in one piece from high quality seamless tubing at forging temperature.

EASY TO INSTALL

Welding and installation time is reduced by these Ladish Reducing Elbows which eliminate the need for handling and welding an additional fitting.

SAVE WELDING COST • SAVE AN EXTRA FITTING
SAVE LOSS IN FLOW EFFICIENCY • SAVE SPACE

A single Ladish Seamless Reducing Elbow eliminates the 90° Elbow and Reducer formerly needed to change direction of flow and reduce pipe size simultaneously. This effects considerable installation economies . . . saving one weld and one fitting at each location . . . with the added advantage of accomplishing the reduction in less space. In addition, the smooth, gradual reduction in diameter of Ladish Reducing Elbows offers less resistance to flow.

Ladish Reducing Elbow Size Range—2" x 1" through 12" x 6" in Standard and Extra Strong Weights. Seamless through 6" x 3"

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

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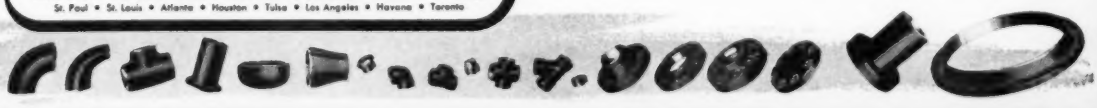
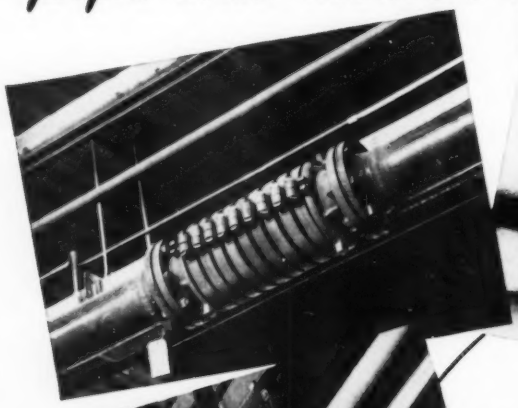
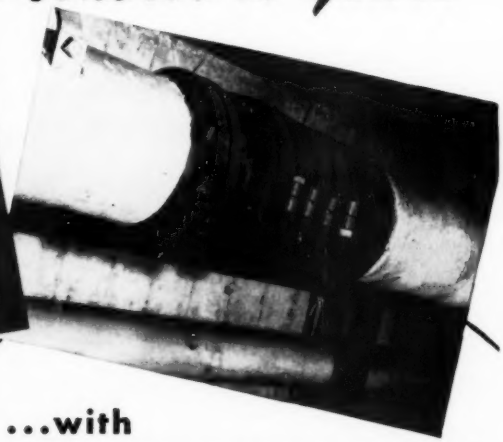


MAINTENANCE-FREE

pipe line motion control is yours





...with
CMH EXPANSION JOINTS

There's no longer any need to spend time and money on periodical maintenance of expansion joints. You can install CMH corrugated expansion joints and forget them . . . there's no packing to pull up or replace. In CMH expansion joints, the curvature of corrugations serves to minimize internal stresses and to provide balance of working stresses. This design coupled with advanced forming methods developed through years of research and experience assures long, trouble-free service. For a new installation or for replacement of obsolete equipment, specify CMH expansion joints for the practical, dependable answer to control of axial, lateral or radial motion in piping.

The illustrations show three typical installations of CMH Controlled-Flexing Expansion Joints.

A CMH TYPE to meet every need

CMH EXPANSION JOINTS are made as Free-Flexing for pressures up to 30 psi, Controlled-Flexing for pressures up to 300 psi and Flexoniflex for pressures up to 1500 psi, temperatures to 1600° F. Sizes range from ⅜" to 30" I. D. and larger. Available in copper, stainless steel or other alloys with flanged or welding ends.

Flexon identifies CMH products that have served industry for over 48 years.

CHICAGO METAL HOSE Corporation

1301 S. Third Avenue • Maywood, Illinois • Plants at Maywood, Elgin and Rock Falls, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

CMH

ONE DEPENDABLE SOURCE
for every flexible metal hose requirement

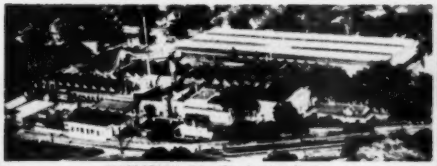
Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

14 AUTO-LITE PLANTS
DETROIT STOKER EQUIPPED

TOLEDO (Ketcham Ave. Plant)
3 DETROIT STOKERS

BAY CITY, MICH. (Bay Mfg. Div.)
3 DETROIT STOKERS

SPRINGFIELD, O. (Springfield Div.)
1 DETROIT STOKER



WOODSTOCK, ILL. (Die Casting Div.)
2 DETROIT STOKERS

FOSTORIA, O. (Spark Plug Div.)
3 DETROIT STOKERS

PORT HURON, MICH. (Wire & Cable Div.) 4 DETROIT STOKERS

SARNIA, ONT. (Electric Auto-Lite Ltd.) 4 DETROIT STOKERS

SHARONVILLE, O. (Bumper Div.)
3 DETROIT STOKERS

CINCINNATI (Lamp Div.)—2 DETROIT STOKERS

FOSTORIA, O. (Foundry Div.)
2 DETROIT STOKERS

TOLEDO (Stickney Ave. Plant)
2 DETROIT STOKERS

TOLEDO (Champlain Street Plant)—3 DETROIT STOKERS

LA CROSSE, WIS. (Instrument & Gauge Div.) 3 DETROIT STOKERS

VINCENNES, IND. (Auto-Lite Battery Corp.)—1 DETROIT STOKER

DETROIT STOKERS

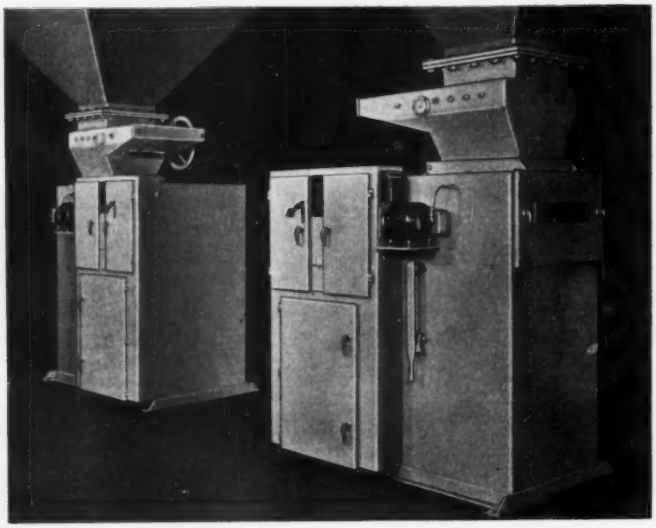
36 DETROIT STOKERS SINCE 1929 . . . FOR

THE ELECTRIC AUTO-LITE COMPANY

Overwhelming Evidence of Satisfactory Performance

DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN



ENDLESS FEED BELT EASILY CHANGED

on S-E-CO. COAL SCALE

It is a simple procedure to replace an endless feed belt on a S-E-Co. Coal Scale. Remove two pins in the by-pass linkage, withdraw entire feeder through the feeder access door, set feeder on its side as shown in the photograph, loosen belt, remove—that's all—two man-hours are more than enough for complete belt replacement.

Easy replacement of the endless feed belt is but one of the many features that make the S-E-Co. Scale the one to use in your boiler plant.

For bulletin write

STOCK EQUIPMENT COMPANY

715P Hanna Building ★ Cleveland 15, Ohio

oxidation rate and extend useful oil life.

In the average steel plant, transformers may vary greatly in age and design, the older types offering little protection from oxidation.

By adopting a regular testing and reconditioning program for their transformer oils, steel plants can keep oil in good operating condition, which should result in a decrease in transformer difficulties and over-all maintenance and operating costs. *AISE paper. No number.*

Smoke Control

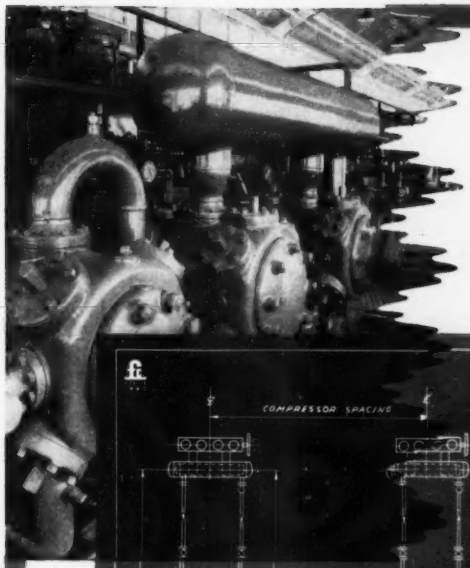
DUST, FUME AND SMOKE SUPPRESSION, *by Aubry J Grindle, Whiting Corp, Harvey, Ill.* During the past 10 years, city, county and state ordinances controlling the amount of man-made contaminants are becoming more and more stringent and being enforced with more sincerity and determination throughout the U.S. The same is true in Canada and other countries.

The Donora, Pa., smog episode, the serious smog problem of Los Angeles County, and other less serious conditions have created a new urgency for cleaning up the atmosphere, both inside and outside industrial plants. Before very long even the home, auto and incinerator will be required to correct their contribution to this nuisance.

Regardless of the amount of truth in the claims of health and agricultural authorities regarding damage by man-made impurities, it is conceded that the increasing hazard does require cooperation of the offending manufacturing plants, manufacturers of corrective equipment and enforcement agencies in finding an economically feasible solution to the problem.

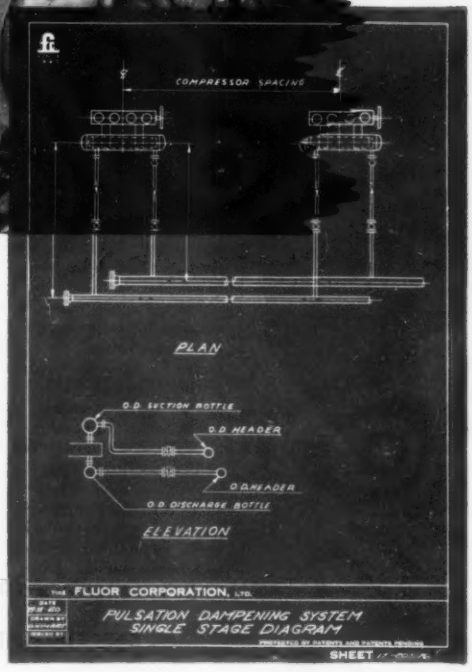
All industry, especially iron and steel plants, takes an active interest in cleaning up the atmosphere, and corrective equipment is now being developed at a rapid pace. Collecting the large particulate matter is no longer good enough, we now find that smog, a combination of smoke and fog, is caused by the submicron material that escapes from all kinds of stacks and, therefore, more efficient suppression equipment is required.

In some localities where there are no temperature inversion problems, simple collectors are suitable, but in many localities it will be necessary to keep the particulate matter emitted with the stack gases under 1/10 gr per cu ft at atmospheric temperature, and to burn the carbon-monoxide gas to less than one percent. In some plants and localities the arresting of SO_2 and other fumes will be required. *AISE paper. No number.*



FLUOR

PIPING SYSTEMS ARE *DESIGNED* FOR PULSE-FREE PERFORMANCE



The Fluor Pulsation Dampening Piping System is the newest and most practical approach to pulse-free piping yet developed. Furnished in prefabricated form, ready for installation, this modern piping system attenuates objectionable pulse peak pressures caused by the reciprocating action of compressors. The operator is assured of trouble-free piping throughout the life of his plant or station—*at an initial cost comparable to conventional compressor piping systems!*

Design of the system is such that conventional volume bottles, laterals and headers are utilized to provide the appropriate components of an acoustical filter—the basic principle of the long-proven Fluor Pulsation Dampener. By choice of line size and arrangement, Fluor's pulsation dampening principle is incorporated as an integral part of initial compressor piping design. This involves no radical departure from the physical appearance of conventional piping systems, except for a reduction in the number of extraneous devices usually required to anchor piping.

Fluor Pulsation Dampening Piping Systems are *guaranteed* to provide a steady, smooth gas flow with minimum pressure drop. Because of this steady flow, many advantages are realized by the operator. Safety is increased by eliminating vibrational stress on piping, heat exchanger and vessels. Compressor operating efficiency is increased, metering inaccuracies caused by pulsative flow are reduced, and maintenance problems common to conventional piping systems are cut to a minimum.

COMPARABLE IN INITIAL COST...

Fluor Pulsation Dampening Piping Systems are designed primarily for new construction. Furnished in prefabricated form, the system is comparable in first costs with conventional piping systems. More important, though, are the savings possible in being able to design and specify related equipment based on a system *free* of pulsative flow and its attendant problems.

Include the Fluor Pulsation Dampening Piping System in your thinking when contemplating new construction. Fluor Engineers are available to explain in full the advantages of this modern piping system—*from the design stage on through the life of your plant!*

A 4-page Bulletin giving detailed information on this "pulse-free" piping system is available upon request.

FLUOR

BE SURE WITH FLUOR

DESIGNERS AND CONSTRUCTORS of Refining, Natural Gas and Chemical Processing Plants.
MANUFACTURERS of Mufflers, Pulsation Dampeners, Gas Cleaners, Cooling Towers and Fin-Fan Units.

THE FLUOR CORPORATION, LTD., 2500 S. Atlantic Blvd., Los Angeles 22, Calif. Offices in principal cities in the U. S. A.
REPRESENTED IN THE STERLING AREAS BY: Head Wrightson Processes Ltd., Teesdale House, Baltic St., London, E.C.I., England

YOU NAME THE PIPE SIZE... UP TO 12"

TOLEDO

will thread it at

LOWER COST!

Pick a winner every time—insist on genuine TOLEDO Pipe Tools for the job! These are the tools preferred for nearly half a century by better mechanics... and used so widely today to thread, cut and ream pipe at *top-speed*... with *less effort*... and *lower cost.*

Your choice—a complete range of 29 quality-built TOLEDO tools for all pipe sizes, ⅛" to 12", and ¼" to 1" bolts... also high-production power pipe machines, up to 2" and 4" capacity ... and portable power drives. Get time-proven TOLEDO advantages for every pipe fitting requirement! Write for catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

RELY ON THE LEADER TOLEDO

POWER DRIVES... PIPE TOOLS... POWER PIPE MACHINES

ACID CLEANING

(*Continued from page* 91)

water soluble you can follow one of several procedures:

When a unit is shut down two to three days its temperature drops to close to room temperature. Condensation of all vapor within the turbine occurs. So when the unit starts up again condensation from the incoming steam is picked up and accumulated water-soluble compounds dissolved.

On installations where initial boiler temperature drops with a reduced load, drop the load for several hours each week. Operate the machine on one control valve in a wide-open position. This advances the turbine moisture region much nearer the inlet and produces a washing effect.

A third method uses a piping arrangement. This piping injects an atomized spray of water into the steam to insure a uniform and gradual temperature reduction of the turbine inlet steam until it reaches saturation and is several percent wet. To avoid any throttling and hence superheat, hold open both emergency stop valves and control valves during the washing.

Some thought has been given to cleaning by both caustic and acid chemicals. Caustic washing under load presents objections on the grounds of practicality. Further, it is not definitely known if the residual accumulations attack bucket fits or other internal parts.

Cleaning with hydrofluoric acid can be done by dissembling the turbine and placing the rotor over a tray holding a 10% hydrofluoric acid solution. The liquid comes up to the base of the blades only. As the rotor turns all blades contact the solution. Later a thorough neutralizing treatment goes on, followed by a water wash.

ELECTRONICS

(*Continued from page* 124)

way constant tension in the web is maintained automatically.

Anti-Hunt Circuit. At bottom of diagram is an anti-hunt circuit, to stabilize the control under adverse operating conditions. When total motion of the dancing roll is less than 6 in., or the drive motor's speed range is more than 2 to 1, an anti-hunt circuit may be required.

This circuit measures rate of voltage change taking place in rectifier and delays this change in proportion to rate at which the change takes place. Circuit provides a biasing voltage when output of the rectifying tubes changes.

Since output voltage of the rectifier is pulsating, the anti-hunt circuit includes a filter made up of resistors R_6, R_7 and capacitors C_4 and C_5. This filter

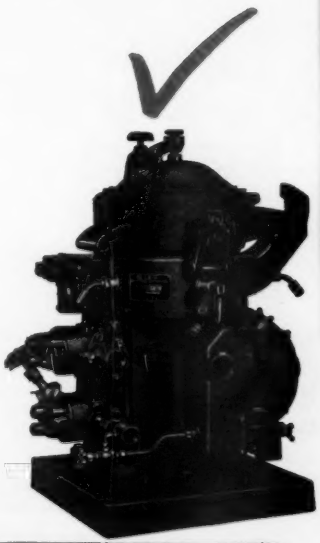
Double Protection

Turbines Require Double Protection from Dirt and Water

Turbines require protection from two different causes of lubrication failure—***dirt*** and ***water***. Removal of dirt alone does only half a job. That is why De Laval Oil Purifiers are so much more effective for maintaining turbine oil than any other means available. They instantaneously remove solid foreign matter and also any moisture that may be present.

It is extremely important to get ***double protection*** when you purify turbine oil, for water is the real trouble-maker as often as not. For example, condensate in oil leads directly to the formation of sludge, and of course there is always the possibility of a major water leak which might lead to serious emulsification and very real trouble.

De Laval Oil Purifiers do not remove oil-soluble additives; action within the centrifuge is entirely mechanical.

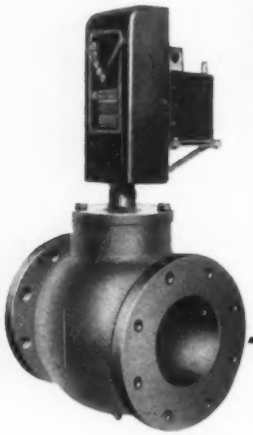


THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval

LUBRICATING OIL PURIFIERS

FIRE EMERGENCY SHUT OFF!

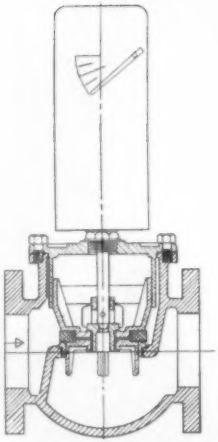


DAVIS NO. 300-S MOTOR OPERATED VALVE

IN industrial plants using large quantities of service water, it is necessary and often an insurance requirement to have a valve installed in the house service system that will close automatically when the sprinkler system goes into operation and remain closed until the fire is extinguished.

The Davis No. 300-S Motor Operated Valve is specifically designed to meet this requirement. It can be actuated by the sprinkler system in either of three ways:

1. Electrically connected to fire pump or electrical alarm circuit.
2. Electrically connected to a pressure switch installed in the supply line to the hydraulically operated alarm in a dry system.
3. Electrically connected to a flow indicator switch located in sprinkler system pipe line.



NO WATER HAMMER!

No. 300-S features Davis' famous tight-closing, non-sticking, single seat, pilot stem design. Renewable disc; no internal packing. Two position motor; current consumption 24 watts when running; no standby consumption. Visible position indicator, 30 second timing.

Davis builds this valve in sizes, ½" to 6", complete with low voltage transformer for connecting direct to 110 or 220 volt, 60 cycle A. C. current shipped complete with wiring diagrams and installation instructions. See your local distributor or write for complete information.

DAVIS REGULATOR COMPANY

Established 1875

2540 So. Washtenaw Ave., Chicago 8, Ill.

Distributors in Principal Cities throughout the United States

gives a smooth dc voltage from E— through potentiometer P_1 to $E+$ and also through C_6 and R_5. When rectifier output is constant, capacitor C_6 is charged to a stable value. As long as voltage is constant C_6 will not pass any current and there is no flow through R_6.

Rectifier Voltage Rises. If the control reactors L and L_1 cause the rectifier output to rise, voltage across C_6 is increased and it is charged to a higher voltage. In doing so, current flows from potentiometer P_1 through C_6 and R_5. A voltage is also applied from R_6 to the center tap on S_1 to the grid of tube T, its cathode, left-hand half of S_1 to $E+$.

This voltage opposes the plus bias on tube T to counteract an increase of current flow through the tube, thus dampening the action set up by reactors L, L_1. This action is only temporary, because when capacitor C_6 becomes charged, current ceases to flow through R_6 and voltage across it becomes zero.

Rectifier Voltage Decreases. If reactors L and L_1 are adjusted by the dancing roll to reduce the rectifier's output, voltage drop across C_6 decreases. Capacitor C_6 is then charged at too high a voltage and will discharge through P_1, R_6 *to* + on C_6. As a result of this action a voltage is applied from $E+$, center tap on S_1, the right-hand half of this transformer, to the cathode and grid of tube T, the center tap on S_1 to + side of capacitor C_6.

This voltage is in the same direction as that applied to the grid and tends to maintain it positive. Again, the dampening action lasts only as long as output is unstable. As soon as voltage settles down to the new adjusted value, the anti-hunt circuit ceases to have any influence.

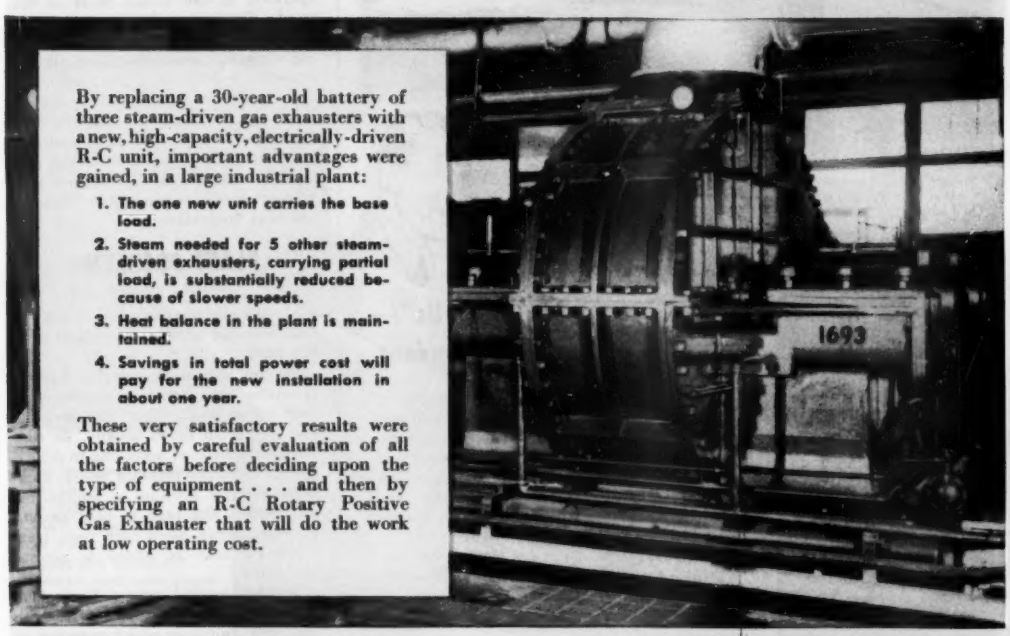
OCEAN IN TEST TUBE

(*Continued from page* 140)

nal concentrations, as well as plain sea water as a control. In still another identical circuit, heated sea water flows. Effect of various chlorine concentrations on marine life (mussels, for example) and of various temperature levels is checked against the control. A secondary purpose of the test is to see whether chlorine in given concentrations accelerates normal sea-water corrosion.

Someone described operations at Kure Beach as "putting the ocean in a test tube." This new test tube will facilitate corrosion testing and widen its scope because of the advantages it offers: (1) a continuous supply of full-strength sea water uncontaminated by industrial wastes, oil films or other pollution that interfere with nests in harbors or near big cities (2) a relatively wide range of sea-water temperature—45 to 85 F (3) a long season of

NEW R·C EXHAUSTER
pays its own way



By replacing a 30-year-old battery of three steam-driven gas exhausters with a new, high-capacity, electrically-driven R-C unit, important advantages were gained, in a large industrial plant:

1. **The one new unit carries the base load.**
2. **Steam needed for 5 other steam-driven exhausters, carrying partial load, is substantially reduced because of slower speeds.**
3. **Heat balance in the plant is maintained.**
4. **Savings in total power cost will pay for the new installation in about one year.**

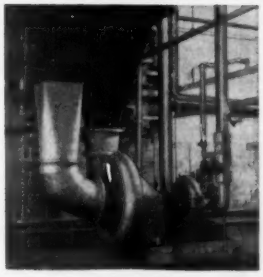
These very satisfactory results were obtained by careful evaluation of all the factors before deciding upon the type of equipment . . . and then by specifying an R-C Rotary Positive Gas Exhauster that will do the work at low operating cost.

Type RCGH Rotary Positive Gas Exhauster, driven by 450-hp synchronous motor. Capacity, 20,600 cfm.

Even though your equipment to handle gas or air may still have years of life, it may be sound economy to replace it with modern, efficient, R-C units of the right type, size and drives to best meet your needs. Our engineers will help you analyze your problem and make unbiased recommendations of either Rotary Positive or Centrifugal equipment, depending upon your specific conditions. This *dual choice* is an exclusive R-C advantage.

With capacities from 5 cfm to 100,000 cfm, R-C units can be closely matched to work requirements, for dependable, economical performance. At Roots-Connersville, almost a century of blower building experience is at your service, without obligation.

ROOTS-CONNERSVILLE BLOWER CORPORATION
151 Powell Avenue, Connersville, Indiana

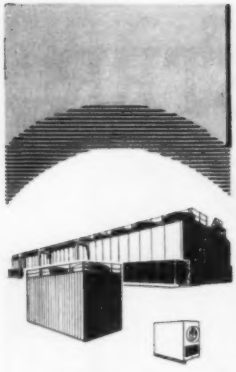


Single-stage, Type OIB Centrifugal Blower in food processing plant. Steam turbine drive; capacity 12,000 cfm.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES



COOLING TOWERS

"That Pritchard Tower Is Sure Doin' A Job For Us"—Says Refinery Superintendent.

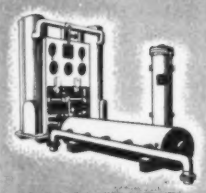
We got a tough assignment back in '49. Our customer needed a tower which would cool more than 4,000 gallons of recirculating water per minute from 105° down to 85° F., only 5° above the ambient wet bulb temperature. His entire process depended completely on 85° water —there could be *no* excuses! Could we do it?

We could, and we did. A few months later the Pritchard series "J" Induced Draft Cooling Tower with separate coil shed pictured above was put into operation.

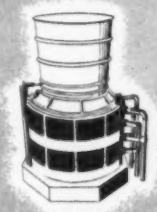
Today, according to the plant superintendent, this tower is consistently equalling or exceeding the design performance in accordance with the test procedures outlined by the ASME, with the operating crew taking their own test readings.

Naturally, when additional water cooling capacity was needed by this customer recently to take care of further plant expansion, another Pritchard Cooling Tower was *specified* for the job.

Why don't you, too, find out about the advantages of using Pritchard Cooling Towers in your plant? Consult your nearby Pritchard representative for full information.



GAS EQUIPMENT



AIR COOLED HEAT EXCHANGERS

Write for Bulletins

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growth for a large number of marine organisms of particular value in studying anti-fouling alloys and coatings (4) a fluctuation in water level with tide rise and fall, which permits observation of water line and intermittent immersion effects (5) protection against destructive effects of storms and high waves.

From its beginnings this International Nickel Co project has been cooperative in the fullest sense of the word. Producers of sometimes competitive products have united against the common enemy—corrosion. In the expanded operations of the future, this same policy will hold. Data accumulated over the years will continue to be exchanged freely and made available to all industry, as well as to the government agencies for whom and with whose cooperation much of the research has been undertaken.

PLANT PROBLEMS

(*Continued from page* 132)

made and engineered system that maintains required boiler concentration from the start.

Or use individual metering blowoff tanks for each boiler to measure volume blown down. They give accurate results. Sketch shows hookup. Be sure tank is constructed according to ASME Code for unfired pressure vessels operating at same pressure as boilers. Select correct size tank to hold amount of water blown down each time. Heat exchanger may be added to recover waste heat.

Another method uses a 3-way float switch and motor-operated valve with reversing switch in motor arranged to blow down a fixed amount and shut off. Float is connected to boiler drum and actuates switch. Combination floats and switches and slow-moving motor-operated valves suitable for this service are available.

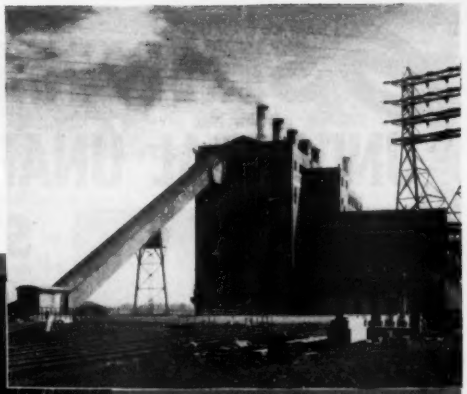
S C PAGE *Buffalo, N. Y.*

EDITOR'S NOTE: Many readers supplied more information than we could print. We'll gladly send it to anyone interested in this problem.

Two Readers Help

TRY ONE OF four methods, say both Hustace H Poor, New York, N. Y., aad R M Walters, Springfield, Pa. Poor gives a flash tank, heat exchanger for cooling before measuring, steam and feedwater flowmeter difference and chloride concentration as suitable methods. Walters gives similar suggestions except he advises using heat exchanger with flash tank or omitting exchanger and using only a flash tank vented to atmosphere. He also favors using an electrical conductivity cell and comparing dissolved solids in feed

To Safeguard Your Plant
COAL HANDLING MUST BE RIGHT
Buy Time-tested Units



This power station of a large Public Utility depends upon Jeffrey coal and ashes handling machinery for day-in and day-out service. They can take no chances. At left, a Jeffrey Belt Conveyor and below a Jeffrey Weigh Larry.

- Ash Handling Systems
- Belt Idlers
- Bin Valves
- Bucket Elevators
- Car Pullers
- Chains and Sprockets
- Crushers and Coke Sizers
- Conveyors — Apron, Belt, Drag, Pivoted Bucket, Spiral and V-Bucket types
- Drive Arrangements
- Feeders — Apron, Belt, Spiral Electric Vibrating
- Pulverizers
- Silo Storage Systems
- Skip Hoists
- Track Hoppers
- Transmission Machinery
- Weigh Larries

Breakdowns are costly . . . failure especially during peak-load periods can be just as disastrous as the failure of the power generating equipment. We know that coal handling machinery must be right . . . have hundreds of installations to prove it. Let Jeffrey safeguard your plant . . . there is an efficient system (or unit) for every type and size of plant. Also equipment for taking away the ashes. For greater efficiency and savings in cost . . . better see us.

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Complete Line of Material Handling, Processing and Mining Equipment

6 SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

Engine room view of a Skinner 4-Cylinder Vertical "Universal Unaflow" Steam Engine at Bassett Furniture Company, Inc., Bassett, Va.

provide economical power for

BASSETT FURNITURE INDUSTRIES, INC.

Bassett Furniture Industries, Inc., operates five plants in Henry County, Virginia. Three of these plants produce finished bedroom and dining room furniture and the other two furnish the accessories. The Bassett name is known to every furniture buyer in the United States.

In each of the three modern plants manufacturing furniture, power is generated by two four-cylinder vertical Skinner "Universal Unaflow" Steam Engines, directly connected to 1250-kw. alternating current generators. Exhaust steam is used for heat and for manufacturing processes.

Bassett Furniture Industries is one of many furniture and woodworking manufacturers which, with hundreds of dairies, breweries, laundries, hotels, hospitals, schools, and institutions, have found a double economy in using Skinner "Universal Unaflow" Steam Engines for the generation of power and the exhaust steam for processing, hot water generation and space heating.

Our engineers are prepared to make accurate estimates, which may prove you can produce dependable power in your plant at a fraction of the cost of purchased power. Write for detailed information about the advantages of Skinner "Universal Unaflow" Engines in your field.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

with those in boiler water. Both warn that flow meters must be carefully adjusted for accurate results.

Analyze for Chlorides

ASSUMING *KT* has venturi meter for finding boiler feed or steam flowmeters for steam flow, here's a good method. Analyze feed for chlorides and record it in grains per gallon or parts per million. Find chlorides in drum in same units and compare the two. This gives number of times drum water has been concentrated. With a fairly constant solid content in drum before each blowdown, number of times water was concentrated tells how much went off as steam. Conversely, it tells how much he blows down.

Percent blowdown is ratio of chlorides in feed to chlorides in drum, times 100. Weight blown down is percent blowdown, times weight of total feed. Be careful not to lose steam from drum-water sample. Use a cooler in sampling line.

D M CARR *Milford, Ohio*

Use Computation Tables

SOME HANDBOOKS GIVE water flow in cfm at a given pressure and temperature through pipes of known size and length. Have operator record time each blowdown valve is fully open and find quantity from: $W = TCD$, where W = weight of water blowdown, lb; T = time valve is open, min; C = flow in pipe, cfm; D = water density, lb per cu ft.

Assume steam pressure constant during blowdown. For accuracy figure water density from steam tables. But if you're in a hurry a value of 62.5 lb per cu ft is accurate enough.

A L PLINT *Kamloops, B.C.*

Cool Below Flash Point

ONE OF THE SIMPLEST and most economical methods of measuring blowdown is to cool below flash point in a heat exchanger. To cool blowdown, use feedwater or makeup water, according to which gives better heat balance in plant. After blowdown is cool, measurement of flow rate is a metering problem that can be solved by standard units made for this purpose.

Heat saved in cooling blowdown gives savings that pay for heat exchanger and meter in less than a year.

ELMER E HETH *Watertown, Wis.*

(*Continued on page* 172)

MILESTONES

IN THE HISTORY OF WATER CONDITIONING

1895 • Commercial introduction of the open or direct contact feed water heater

1900 • Commercial application of heat as an aid in water softening

1910 • Vertical sedimentation tank with conical uptake funnel and conical bottom

1916 • Cochrane differential chemical proportioner

1921 • Development of reboiler counterflow deaerating heater to improve degasification of feed water

1922 • Backwashing filters with hot, softened water from sedimentation tank

1924 • Development of cross-flow tray type deaerating heater

1925 • Use of jet heaters with Hot Process Water Softener

1928 • Supplementary Phosphate Treatment

1929 • Commercial application of Cochrane Parallel Downflow Deaerator • Development of Atomizing Deaerator for marine use

1931 • Primary treatment with phosphate

1933 • Deaeration by atomization (pat.) of the hot, softened water

1934 • Jet tray deaerator with vent concentrating preheater

1935 • Deaerating Hot Process Softener developed to large capacities

1939 • Recirculation of sludge in hot process softeners • Use of hot process softener for silica reduction

1940 • Use of phosphoric acid in hot process softener as primary softening reagent

1943 • Commercial application of cold water deaerators

1947 • Development of Hydromatic Single Control Valve

1948 • Gas concentrating jet heater for Hot Process Softener

1949 • Hot Process 2-stage Softener, lime treatment followed by zeolite

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INLET
DRAIN
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• Horizontal inline connections—simplifies piping.
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• Large gasket area.
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• Bottom drain or inlet connection.

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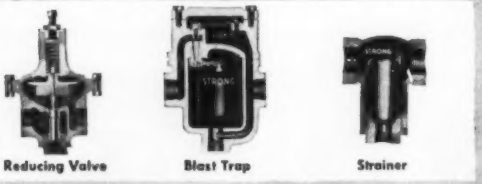

Reducing Valve | Blast Trap | Strainer

STRONG

Use Gage Glass

CHECKING BLOWDOWN by gage glass is suitable if all conditions are known. *KT* must know (1) volume of water blowndown (2) density of water at absolute drum pressure (3) steam generated by boiler during blowdown (4) if feedwater flow to boiler is stopped (5) whether continuous blowdown is open or closed and (6) exact duration of blowdown period.

Use spare cold boiler to find cu ft in 1 in. of boiler water above normal level. Water-column blowdown line can be used to tap water. Find actual weight at operating conditions by using steam-table data, expressing in terms of 1 in. of water-column height. If no feedwater enters drum during blowdown, figure difference between 1-in. drop of water column and steam generated during blowdown period. This is quantity blown down. If continuous system is working during main blowdown, deduct amount passing through continuous unit.

ARTHUR BELTON *Montreal, Can.*

Orifice Plate Best

USE ORIFICE PLATE in each blowdown line or in a common header if total blowdown is to be measured. Use cast monel S for orifice plate. It prevents erosion. Manometer or recording differential flow-meter makes good secondary element.

Weighing is good, too, when percentage of flash is read directly from charts. These are obtainable from a number of sources.

Where continuous blowdown isn't used and estimate of average blowdown is wanted, chlorides in feed and boiler water can be periodically determined. Method also works with continuous and manual blowdown but flow of each can't be separated.

MELVIN EVANS *Chicago, Ill.*

Flash-Tank Gage OK

MAKE USE OF sight gage on flash tank for simple, accurate measurement. Time, needed to increase level a given height with drain valve closed, is a measure of rate-of-water collection. Weight is found by using flash-tank dimensions.

Once quantity has been figured for various time intervals it can be plotted for easy reading. Use relation that takes heat loss to atmosphere into consideration when figuring quantities.

Orifice plate works, too. Install it in drain line from flash tank and find flow in same way as above. Plot for easy reference.

B L TAYLER *Laurel, Del.*

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Our sales representatives, located in major industrial market centers, are ready to sit down with you and discuss your power transmission needs, to help you select correct types and sizes. Our service is prompt. Write for our latest catalog and give us an idea of your requirements. Your inquiry will receive our careful attention.

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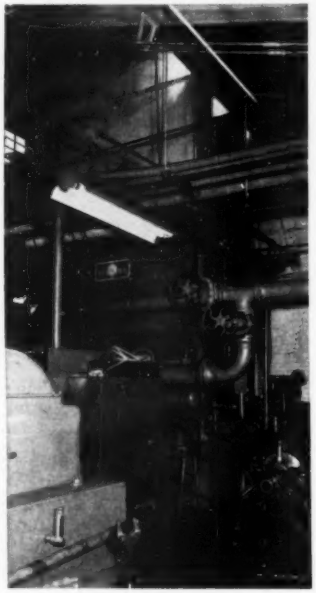
You Get Trustworthy Liquid or Gas Cooling With Great Cooling Water Savings from the NIAGARA AERO HEAT EXCHANGER

● You can cool air, gas, water, oils, chemicals, electric and power and process equipment, engines, mechanical processes with lower cost and really accurate control of temperature with the Niagara Aero Heat Exchanger.

You are assured of uniform, constant production and quality from any process . . . steady, reliable operation . . . lower cost for more dependable cooling. You can have closed system cooling with freedom from scale, dirt, corrosion and maintenance troubles. You can accurately cool more than one type of liquid with one machine.

The Niagara Aero Heat Exchanger uses atmospheric air to cool liquids and gases by evaporative cooling. You can remove heat at the rate of input to keep accurate control of gas or liquid temperature. You can put heat back into the system to save the losses of a "warm-up" period or to equalize the effect of load variations.



Great savings in cooling water and savings in piping, pumping and power return the cost to you quickly. The Niagara Aero Heat Exchanger can save you approximately 95% of your cooling water cost. Write for Bulletin 96.

NIAGARA BLOWER COMPANY

Over 35 Years Service in Industrial Air Engineering

Dept. P. 405 Lexington Ave. New York 17, N. Y.

Experienced District Engineers in all Principal Cities

SPREADER STOKERS

(*Continued from page* 81)

range of 20 to 100% of load has been no problem under either test conditions or normal operating conditions. When load has been raised or lowered rapidly some short bursts of smoke have been produced. But such rapid rate of load change is not essential to our system except under emergency conditions. The value of overfire air at both high and low loads has repeatedly been demonstrated when the overfire air has been reduced or shut off entirely.

The boiler under test carried about 10% overload successfully. Higher loads produced objectionable smoke, but no other limitations appeared within the boiler.

Conclusions. The tests together with day-to-day observation of the boilers indicate spreader-stoker-fired boilers have a definite application for peak-load and standby service. Further progress in design and development along several lines will still further enhance their value in this service.

By reinjecting the total catch of the dust collector to the furnace, inlet loadings to the collector rise to a point where it is difficult to maintain dust emission from the stack within reasonable values. Higher-efficiency collectors are not the answer to the problem since they only serve to increase the loading at the collector inlet. Final solution of this problem will likely involve 2-stage collection of the dust.

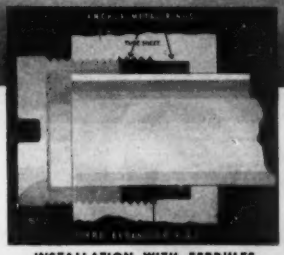
As an example, the inlet scroll of the induced-draft fan could be made to serve as a low-efficiency collector. This would remove most of the coarse material that contains high percentages of combustible. This dust, then, would be returned to the furnace for reburning. A second collector on the outlet of the induced-draft fan would remove the finer ash, which is relatively low in combustible content and hence could be discarded. Such 2-stage collection might cause some slight drop in efficiency. But dust emission could be brought down to any desired value.

Had economizers and air heaters gone in on these boilers, a rather large amount of coarse dust might have been caught in the hoppers ordinarily installed with such devices. In such a setup, these hoppers might be viewed as primary collectors and save the cost of an additional coarse-ash collector.

Overfire air in spreader stokers is extremely important. We find that the overload capacity of the boiler is limited by overfire air. To get around this limitation we are now studying the possibility of increasing overfire-air quantities so we may carry additional overload without smoking.

The excessive amount of overgrate

"ANKORITE" SURFACE CONDENSER TUBE PACKINGS



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"ANKORITE" Metallic and Fiber Ring Combination holds condenser tubes free from leakage, with or without ferrules. Not affected by fresh or salt water or sewerage contamination.

Metal rings bond the tubes to tube sheet and aid in preventing electrolytic tube destruction.

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air, together with the rather large minimum air flow required through the grates, works against economical low-load operation. While this may be an inherent defect common to all stokers, it is thought that more careful consideration of the problem by stoker manufacturers may serve at least to lower the point where excess air begins to have a major effect upon efficiency.

Maintenance of live banks on these boilers is uneconomical and leads to critical smoking conditions. If load conditions permit, dead banks prove much better. Experimentation is now under way to determine if dead banks cannot be maintained even more economically and with less smoke nuisance by letting the fire go completely out and rekindling with gas or oil torches.

Combustion control on these boilers requires careful attention to get maximum efficiency over the load range without constant adjustment by the operators. In our case we are able to do this within the load range of the controller. The only adjustments required are (1) grate speed when the ash of the coal varies, and (2) throw of the coal when its size changes. An additional control added to the stoker automatically prevents the undergrate air from being decreased below the point where overheating of the grates occurs.

While it may still be too early to judge with certainty the results with no soot blowers, draft loss and flue-gas readings to date indicate satisfactory operation without blowers.

Shortly after the boilers went into operation, the coal strike forced us to burn coals of poor quality. Heating value dropped to around 8000 Btu while ash content rose upwards of 30%. Even under such adverse conditions it was found possible to carry full load on the spreader-stoker-fired boilers while pulverized-coal and underfeed stoker-fired boilers with similar coals suffered severe losses in capacity.

In comparing operation to date of spreader-stoker-fired units with existing underfeed stokers running under the same load conditions, most points are definitely in favor of the spreader-stoker-fired unit.

3 Refrigerating Plants

(*Continued from page 94*)

plants permits swapping experience, operating skills and maintenance equipment whenever necessary. With such flexibility of operating forces maximum effort can be put into a job when needed. Each plant is well equipped with machines and tools for quick repair of faulty compressors, motors, pumps, condensers, coils, pipes, valves and other essential units. By careful

Only Ingersoll-Rand's

NEW DIESEL

gives you BIG-ENGINE PERFORMANCE in a small package ...195 to 375 hp

NEVER BEFORE *have these Contradictory Characteristics been combined in one diesel engine*

MOVABLE Can be mounted on welded steel skid base for easy moving.	*but*	**NOT Automotive Type** Built for continuous, full-load operation.
LOW WEIGHT Low transportation, rigging and maintenance costs.	*but*	**Moderate Speed** 900-1000 rpm.
SMALL SIZE Minimum engine room space required.	*but*	**Big-Engine Design** For longer life and more reliable operation.
HIGH FUEL ECONOMY 0.40 lb fuel per hp-hr means sustained low operating costs.	*but*	**Small Pistons** 7" bore x 8½" stroke.
PERFECT BALANCE Minimum concrete foundation required.	*but*	**No Balancing Devices** 6 or 8 cylinder engine with in-line construction.

Until now the only Diesel Engines in the 195 to 375 hp range were either automotive-type units at top limits of speed and rating, or heavy, slow-speed and oversize derated engines. But now with the new Ingersoll-Rand TS Diesel you can get the small size and light weight of an automotive unit—plus the operating economy, stability, and long life of the big engine.

In the TS Diesel you'll find big-engine features like these: Big 5¼" crankshaft . . . full-floating, interchangeable aluminum-alloy shells for both main and crankpin bearings . . . full pressure lubrication . . . individual cylinder heads . . . replaceable cylinder liners . . . removable valve seat inserts . . . single-hole injection nozzles . . . gear-driven supercharger . . . and many others.

Call any Ingersoll-Rand branch office for complete facts on the new TS Diesel, and you'll see why it has been called the outstanding advance in engine design in the past decade. It is an ideal engine for every type of heavy-duty service.

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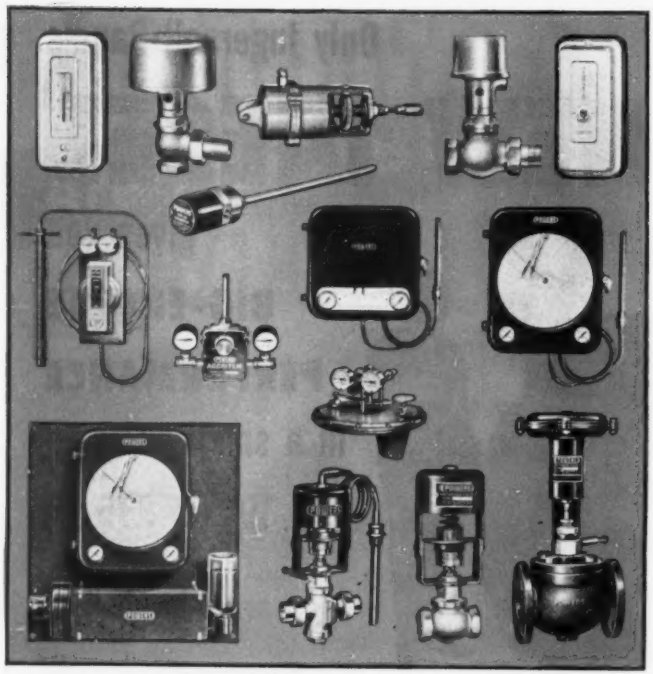

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consideration of their qualifications and training, men are assigned to jobs they know and do best. Liberal employe policies keep turnover low and prevent unnecessary shutdown sometimes experienced with new operators.

Maintenance. There are several schools of thought in refrigerating-plant maintenance. This company's policy is an annual overhaul and inspection of all equipment. During this annual inspection all necessary repairs and adjustments are made. This procedure is based on operating requirements — failure of any part might mean loss of refrigerating capacity in both cold-storage rooms and pipelines.

Condenser-water cooling towers are the atmospheric type. They are painted twice a year to preserve wood and prevent deterioration. Only replacements made in tower wood have been sections damaged by operators and painters stepping on them. Condenser water is treated with chromate and caustic soda.

Maintenance of temperature-recording instruments is performed by one man, who puts in about 5 hr per month doing routine oiling, inspection and cleaning. Once every year a more thorough cleaning, oiling and general inspection of mechanical and physical conditions of instruments, thermohms, lead wires and other parts is done by a Leeds & Northrup service man. This care has paid off; during 6-year period instruments have operated, only renewal has been one small motor.

Brine-pipeline coolers are checked and cleaned regularly along with other coolers in the plants, since failure of the pipeline or its coolers might mean disruption of service in one or more of the 125 odd stores and shops served. A careful watch is kept for pipeline leaks. By means of the valves most leaks can be isolated without seriously reducing the brine supply. A special crew is kept on 24-hr call to repair any leaks that might develop. A daily check of brine concentration is made to see that specific gravity is right for temperature used.

Maintenance records for all jobs performed are carefully made out and filed. A separate record for each major piece of equipment permits periodic review of its performance. When a specific trouble, major or minor, occurs more than once in a unit, it is torn down and all possible causes of trouble are checked. This policy, which might be called "aggressive" maintenance, has paid dividends in many ways. Just by constantly studying operating and maintenance records, the operator frequently wards off what might be a serious shutdown by anticipating threatened breaks. This is mighty important when you have three plants loaded with perishables and eight miles of brine pipe

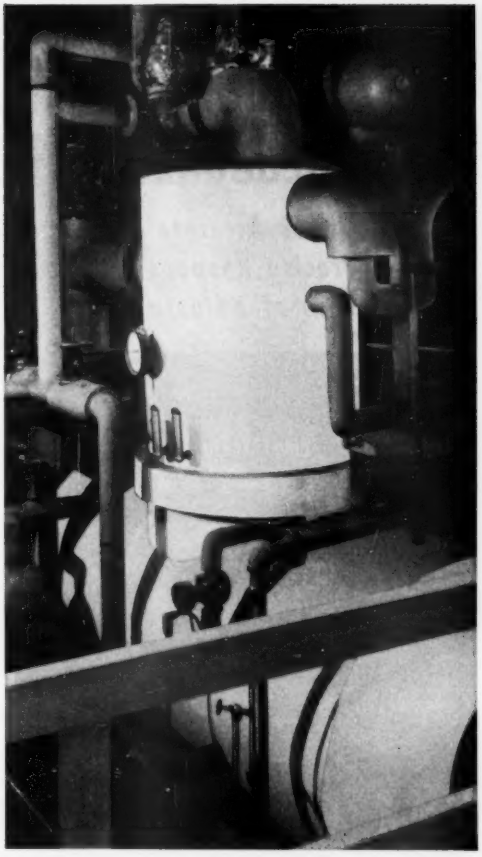
We have been asked:

Can insulation save my buying a new feed water heater?

Here's what a manufacturer wrote us recently: "Our factory uses steam for processing. Condensate return lines, which are now uninsulated, total 2106 feet in length. Our peak loads average 3 hours daily, and the feed water heater can furnish only 80% of recently increased load. Of course, this makes steam costly and inadequate for full production. Will it be necessary to buy a new feed water heater to increase the efficiency of our boiler, or can the application of insulation to the condensate lines do the job?"

Here's what we advised: While an additional feed water heater might solve your problem, it isn't necessary. Insulating your condensate lines will prevent loss of heat on the way back to the boiler and consequently will increase boiler efficiency. Too, insulating the lines will cost far less than installing a new feed water heater. The question then is—which kind of insulation will do the best job? Air-cell pipe covering would be adequate if peak loads were brief and occasional and return lines were short. However, the loads here are too heavy and the lines too long to make air-cell desirable.

Insulation of the return line with 85% Magnesia pipe covering is the best way to attain economical operation. The extra cost of this type of insulation will be repaid, under present conditions, within just a few months.



Armstrong engineers run across questions like this every day. Helping to solve these problems has given them valuable knowledge that could be put to work on your next insulation problem. You'll find these trained engineers in your near-by Armstrong office, and they will be glad to help you.

IF YOU HAVE ANY QUESTIONS involving industrial insulations for low- or high-temperature applications, we'll do our best to help you solve them. Just address a letter or post card to Armstrong Cork Company, 7001 Maple Avenue, Lancaster, Pennsylvania.

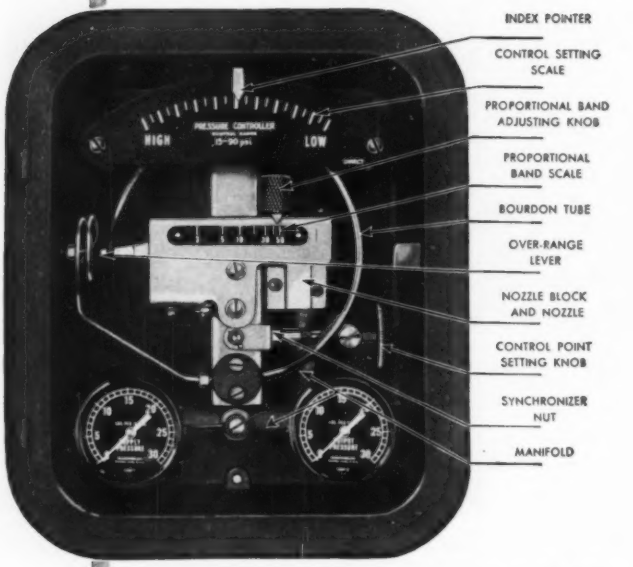
ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

MASONEILAN MODEL 2700 PRESSURE CONTROLLER

Offers Accurate Proportional Control...
Precise Response...
Ease of Adjustment...



...YET IS MODERATELY PRICED

Masoneilan No. 2700 Pressure Controllers are especially designed for applications requiring accurate control when expensive instruments are not warranted. The pneumatic feedback, usually found only in more elaborate proportional controllers, assures precise response. The Control point setting mechanism provides accuracy of adjustment and easily read expanded index scale. Control action is reversible with either bourdon or bellows. The controllers are furnished in two case styles: a universal case for panel mounting; and a specially designed case for valve or wall surface mounting.

Applications include — pump governors, steam pressure reducing stations, gas well pressure reduction, and many others requiring small to intermediate proportional band.

MASONEILAN **MASON-NEILAN REGULATOR COMPANY**
1186 ADAMS STREET, BOSTON 24, MASSACHUSETTS, U. S. A.

Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago St. Louis • Philadelphia • Houston • Denver • Pittsburgh • Cleveland • Cincinnati • Tulsa Atlanta • Los Angeles • San Francisco • Salt Lake City • El Paso • Boise • Albuquerque Detroit • Charlotte, N. C. Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

tacked to your refrigeration machines.

Electrical Setup. Power comes into these plants at 13.0 kv and is stepped down to 440. Synchronous motors are used to drive all compressors.

Yale fork trucks for transporting products to and from cold-storage rooms operate on Edison (nickel-iron-alkaline) batteries, Fig. 9. Trucks are tilting telescopic type. Two-circuit Hertner motor-generator battery chargers bring batteries up to charge every night. Truck lubrication has to be watched carefully because use of too viscous an oil in low-temperature room puts an extra load on batteries, reducing allowable operating period between charges. Palletizing, using battery-powered fork trucks, was started about a year ago and has proved well worth the investment.

By suitable planning, careful operation and regular maintenance the Quaker City Cold Storage Co, Inc, has licked problems that could easily develop into major headaches.

. . . With Power Readers

(*Continued from page* 5)

ership. Dick, we hope you're a member of the POWER family for another 57 years!

"IN SEOUL . . ."

(ED NOTE: Not long ago we received a rush request from C S Coler of the Economic Cooperation Administration for a copy of POWER'S *Mid-Year Buyers' Guide.* He needed it to replace one lost in the evacuation of Seoul. He's been back in Seoul again, and here's what he says about life in that war-torn city.)

Thank you very much for sending the copy of your Mid-Year Buyers' Guide. It arrived last week while I was again in Seoul. The Koreans are cleaning up the rubble and working hard to make the city habitable and presentable.

While there I attended the first meeting of the Rotary Club in Seoul since the invasion. Twenty-three of the 45 prewar members were present. Ten are missing as a result of the invasion—four Koreans and six non-Koreans. . .

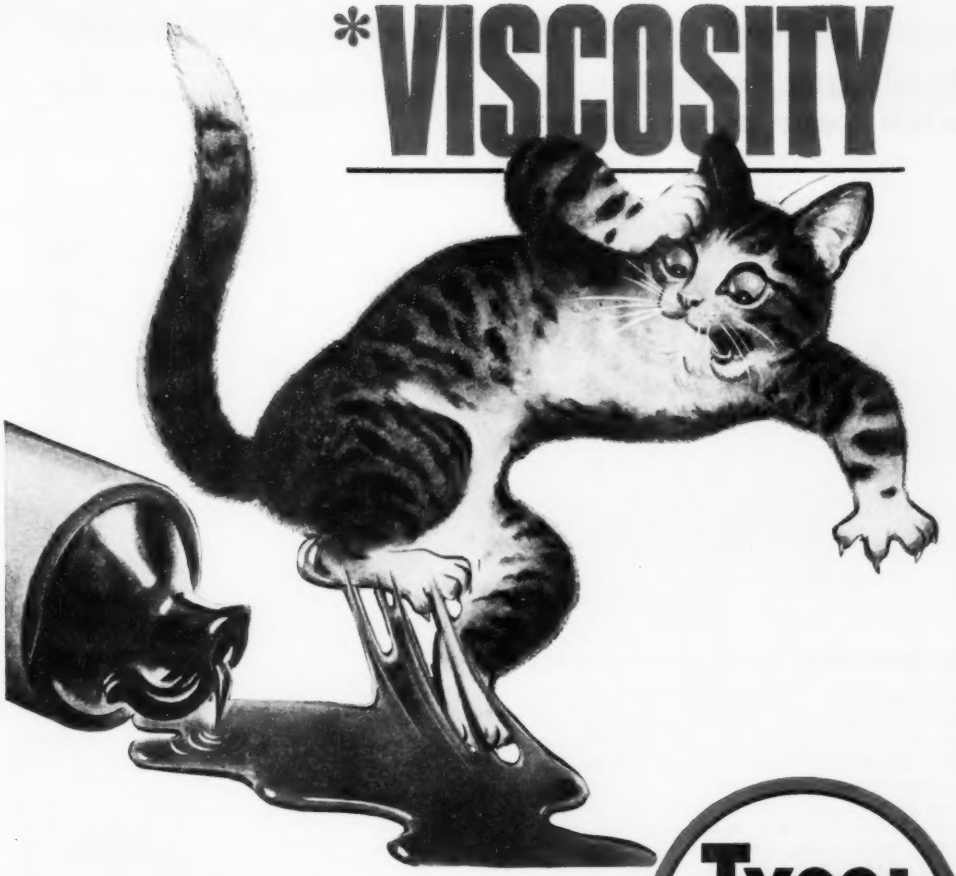
The cost of the luncheons before the invasion was 1000 won. Last week the price was 4000 won. The present Army rate of exchange is 4000 won to the dollar. . .

Pusan, Korea C S Coler

Bituminous Coal Research, Inc, has formed a special committee to keep in constant touch with a wide range of research on fuels and their utilization, particularly where they might affect future coal markets or dictate a change in BCR research activities or objectives.

Philadelphia Electric Co has gone to aerial photography to check tonnage of coal stock piles. This novel inventory method got under way in August and was completed during October.

*VISCOSITY



All equipment will last longer — give better service — if you use the proper lubricant. That's why you'll find it profitable to use Tycol high quality oils and greases.

There's a reason! No matter what your lubrication need — for roll neck bearings or mine cars, Diesels or high speed textile spindles, turbines, paper calenders or steam engines . . . where *VISCOSITY, penetration, extreme pressure is a factor — Tycol has a lubricant suited to your specific requirements.

Refined from selected crudes, Tycol lubricants are exceptionally resistant to breakdown which means greater economy . . . longer life for every type of equipment.

Let us show you the extra value in every measure of Tycol lubricants. Write your nearest Tide Water Associated office today.

TYCOL

INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh • Philadelphia • Chicago Detroit • Tulsa • Cleveland San Francisco • Toronto, Canada

TIDE WATER ASSOCIATED OIL COMPANY

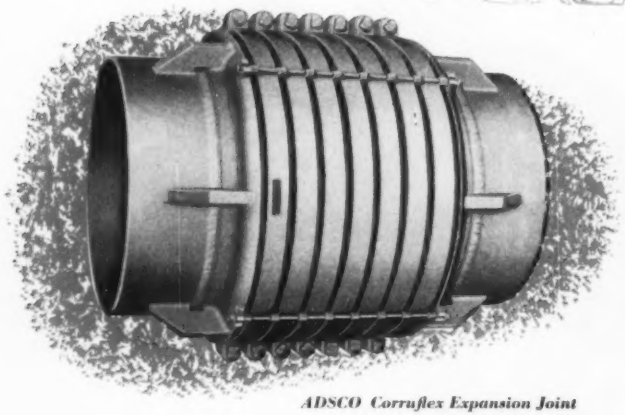
17 BATTERY PLACE · NEW YORK 4, N. Y.

*LEARN WHAT THIS PRODUCT CHARACTERISTIC MEANS TO YOU — READ "LUBRICANIA"

This informative handbook, "Tide Water Associated Lubricania," gives clear, concise descriptions of the basic tests used to determine important properties of oils and greases. For your free copy, write to Tide Water Associated Oil Company, 17 Battery Place, New York 4, N. Y.

REFINERS AND MARKETERS OF VEEDOL — THE WORLD'S MOST FAMOUS MOTOR OIL

Don't get caught with your plants down!



ADSCO Corruflex Expansion Joint

As America gears for more production

downtime *must* be eliminated, but it isn't going to be easy! Higher production...with greater wear on all equipment...will keep your maintenance crew jumping. In all probability, you'll suffer personnel losses and high turnover. You know you're going to have some tough maintenance problems.

One of them you can lick right now with ADSCO *Corruflex* Expansion Joints. Installed in your pipe lines, they require no maintenance. There's no packing...no lubrication...no adjustment in service. And they're *dependable*...made by the pioneers of the expansion joint industry, manufacturers of the most complete line of expansion joints in the world!

ADSCO *Corruflex* Joints are available in sizes from 3" to 24", single or double units, single or multiple corrugations, with or without self-equalizing rings, and with flanged or welding ends. They are supplied in copper, stainless steel or other alloys and with internal sleeves if required.

Corruflex Joints have traverses ranging from fractions of an inch to 15" and operate under pressures from vacuum to 300 psi and temperatures from sub-zero to 1600F.

SEND FOR NEW 16-PAGE BULLETIN

Simplified selection charts . . . summary of installation practice . . . complete data on all *Corruflex* Joints . . . *Bulletin No. Z-35-51.*

Expansion Joints
Steam Traps • Meters
Anchors • Guides

ADSCO Since 1877

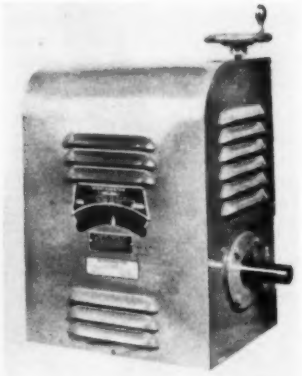
Heat Exchangers
Strainers • Separators
Casing • Supports

AMERICAN DISTRICT STEAM COMPANY, INC. ★ North Tonawanda, N.Y.

EQUIPMENT NEWS

(*Continued from page* 150)

For more data on these items, use post cards, p192a. Identify request with P and number.

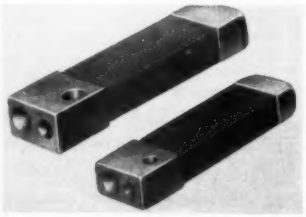


VARIABLE-SPEED UNIT **P139**

Tandem-belt design forms basis for this new line, the *Allspeed Drive*. Units, from 1- to 15-hp, offer speed variation up to 16 to 1.

At 1725-rpm input, 1-hp unit offers range of 215 to 3450 rpm; output speed of the 15-hp unit will vary from 350- to 2220-rpm with an input speed of 1750-rpm.

Worthington Pump and Machinery Corp, Allspeed Drive Div, Holyoke, Mass.



RIVET SETS **P109**

Spalling and mushrooming of rivets are things of the past according to maker of *Wedge Grip* safety steel rivets. Five standard sizes for ¼ to 9/32 in. rivets.

M E Cunningham Co, 183 East Carson St, Pittsburgh 19, Pa.

DUST COLLECTORS **P113**

Louvered, cone-shaped element forms the heart of series of dust collectors, *Types C, CC, SC*. Air or gas undergoing cleaning

Shafts take a turn for the better on pillow blocks with TIMKEN® bearings

WITH shafts turning on Timken® bearings, you're assured of long, trouble-free service, virtually friction-free operation, and minimum maintenance, even under the heaviest loads.

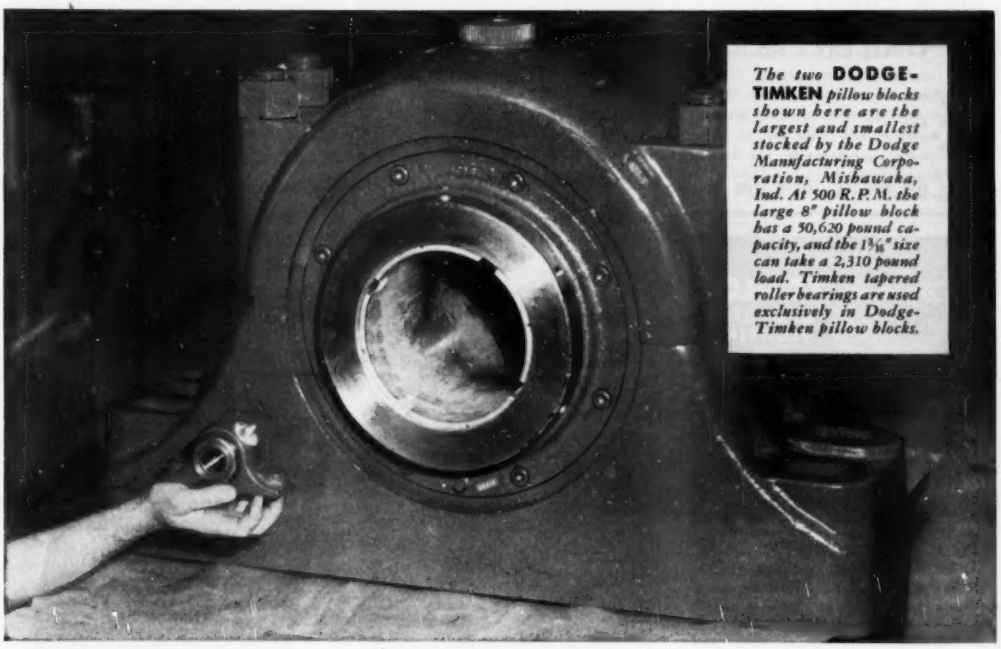
Line contact between rollers and races gives Timken bearings extra load-carrying capacity. True rolling motion and incredibly smooth surface finish make friction practically negligible. Shaft wear is eliminated. And because of tapered construction, Timken bearings can take radial and thrust loads in any combination.

Tighter closures are permitted that keep lubricant in—dirt and moisture out. Lubrication and maintenance costs are reduced.

Timken bearings are made of the finest steel ever developed for tapered roller bearings—Timken fine alloy steel—and under normal conditions will last the life of the equipment with which the pillow blocks are used.

Backed by half a century of bearing research and development, Timken bearings are first choice throughout industry. If you need pillow blocks, specify those equipped with Timken tapered roller bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



The two **DODGE-TIMKEN** *pillow blocks shown here are the largest and smallest stocked by the Dodge Manufacturing Corporation, Mishawaka, Ind. At 500 R.P.M. the large 8" pillow block has a 50,620 pound capacity, and the 1 3/16" size can take a 2,310 pound load. Timken tapered roller bearings are used exclusively in Dodge-Timken pillow blocks.*

WE MAKE OUR OWN STEEL

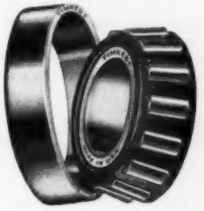
The special grade alloy steel which gives Timken bearings their strength and resistance to wear, is made in our own steel mills.

The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬭ AND THRUST ⬭ LOADS OR ANY COMBINATION

"GUNITE" Concrete

(SINCE 1915)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •

• • •

STEEL & PIPE ENCASEMENT

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FIREPROOFING •

GUNITE CONCRETE & CONST. CO.

1301 Woodswether Road
KANSAS CITY 6, MO.

DISTRICT BRANCH OFFICES

S. T. Burton Co., 228 N. LaSalle St., Chicago 1, Ill.
George R. Lewis Co., 1200 Baker Bldg., Minneapolis 2, Minn.
R. H. Mueller Co., 6625 Delmar Blvd., St. Louis 5, Mo.
Ole K. Olsen Co., 823 Perdido St., New Orleans, La.
Philip D. Barnard, 2036 Addison, Houston 5, Tex.
Western Steel Prod. Co., 1755 W. 13th Ave., Denver 4, Colo.

LOCKED IN STRENGTH of Tri-Lok open steel flooring gives efficient load distribution, even on long spans. Get maximum strength, light, and air with minimum weight. Available in Rectangular, Diagonal, and Super-Safety U-type Flooring, and Stair Treads of all kinds.

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok grating can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc. Write for Bulletin MW1140.

DRAVO CORPORATION

National Distributor for the Tri-Lok Company

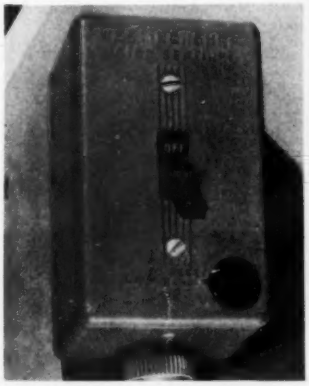
Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

For more data on these items, use post cards, p192a. Identify request with P and number.

passes at high velocity over the louvered surface. Because of the slot form, aerodynamic forces are set up. Thus, dust particles are pushed away from the cone face and clean air leaves through slots. Dust goes on to outlet end of cone.

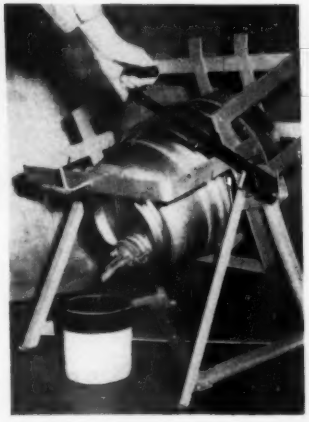
Aerodyne Development Corp, 879 Addison Rd, Cleveland 15, Ohio



MANUAL MOTOR-STARTER P147

Motor Sentinel Class 10-023 is equipped with indicating light to show when motor is running. Well suited for protecting small industrial appliances. Available as double-pole switch with ratings up to 1-hp, 250-v ac or dc. Bimetallic overload protection allows momentary overloads but quickly disconnects motor on sustained overloads.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



BARREL TILTER P127

Ratchet-controlled, long-handled, structural-steel barrel tilter provides safe way to draw off acid and other liquids from

If your plant requires

- DIRECT HEATING OF VAPORS
- DIRECT HEATING OF LIQUIDS
- DOWTHERM INDIRECT HEATING
- STEAM GENERATORS
- STEAM SUPERHEATERS
- WASTE HEAT BOILERS

place the selection of the specific type in specialized hands . . . and obtain optimum efficiency.

Petro-Chem Development Company engineers are heating specialists . . . they can supply the whys and wherefores of indirect versus direct heating and the economics of both.

Every day more than 600, oil and gas fired, Petro-Chem Iso-Flow* installations in the petroleum, chemical and allied industries, demonstrate the efficiency of their design and installation.

***Patents issued and pending**

PETRO-CHEM DEVELOPMENT CO., INC.
120 East 41st Street, New York 17, N. Y.

Representatives:

Bethlehem Supply, Tulsa and Houston • Flagg, Brackett & Durgin, Boston • D. D. Foster, Pittsburgh • Faville-Levally, Chicago • Lester Oberholz, Calif.

Synchronous Motors

DRIVE THE LOAD...

CORRECT THE POWER FACTOR

CLIP DOLLARS OFF POWER BILLS

If your need is for Big Motors and Controls, look to Electric Machinery . . . rely on its high degree of industrial specialization . . . its long experience and the uncommon competence in design and manufacture. Electric Machinery offers that type of extra value that gives users more for their money. E-M Synchronous Motors deliver extra value in these particulars.

Power Factor Improvements. Penalty payments for low power factor are eliminated or substantially reduced. **Power Savings.** Dollars clipped off power bills because E-M Synchronous Motors are highly efficient. **Drive Simplicity.** E-M Synchronous Motors, shaft-mounted on driven machines, eliminate belts and speed reducers. **Minimum Maintenance.** Coddling and hovering are unnecessary because of direct connection. **All they require is occasional cleaning. Constant Speed** is not affected by variations in load or voltage. This is an extra value for certain types of crushers and pumps. **Direct Drive** to the load . . . E-M Motors down to 72 rpm are profitable drives for compressors, pumps, grinders, pulverizers. **Riding through "Voltage Dips"**, thus avoiding shutdowns and processing blocks . . . you can rely on this with E-M Synchronous Motors. **Saving Space and Building Costs.** Trim, compact, direct-connected E-M Synchronous Motors do make these dollar savings. **P.S.** E-M field men, competent engineers, can give you case studies to demonstrate everything recorded above. They'd like to serve you. Get this written knowledge on your production team.

ADD THESE DATA BOOKS TO YOUR LIBRARY

Your selection of any or all of these Data Books will be sent you promptly. They're factual pieces with technical data precisely presented. Written by E-M engineers, they're a storehouse of useful information on Synchronous Motors.

- ☐ ABC OF SYNCHRONOUS MOTORS . . . A "tell-all" story . . . how synchronous motors are built, how they work, their application in industry.
- ☐ 8 PROFIT MAKING FEATURES OF SYNCHRONOUS MOTORS. Pictures and describes advantages of synchronous motors direct-connected to various types of drives.
- ☐ SELECTION AND APPLICATION OF SYNCHRONOUS MOTORS. Discusses application, power factor, excitation, starting, protection, maintenance.
- ☐ HOW TO CONTROL YOUR SYNCHRONOUS MOTOR. Discusses the control for starting and synchronizing these motors and explains the polarized field frequency system.
- ☐ POWER FACTOR AND WHAT TO DO ABOUT IT. A digest on power factor calculation, the need for correcting low power factor and how it can be done.

ELECTRIC MACHINERY MFG. COMPANY
1333 TYLER ST. N. E., MINNEAPOLIS, MINN.

● Please send me the literature as checked above.

Name_____

Title_____

Company_____

Address_____

City_____ State_____

1200-TPA-2092

SPECIALISTS IN

BIG MOTOR ENGINEERING

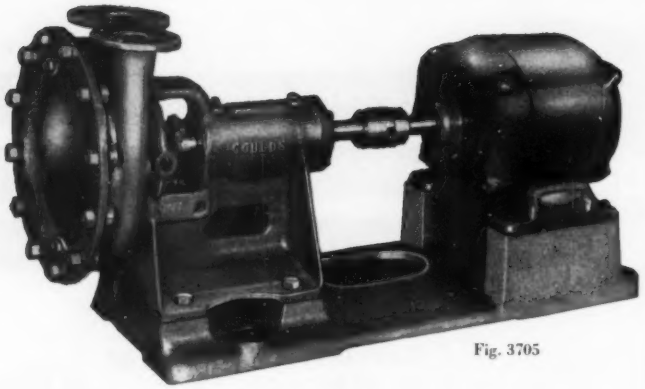


Fig. 3705

For Outstanding Service Handling Corrosive Liquids—

Goulds new stainless steel centrifugals

ADVANCED PUMP DESIGN--

The Goulds 3705 stainless line represents the last word in effective design. Fig. 3705 pumps will give you efficient, dependable, 24-hour service in handling corrosive liquids—at low cost.

CAPACITIES—

Goulds stainless steel centrifugals are made in 8 sizes with capacities to 750 G.P.M. and heads to 180 ft. depending upon capacity.

ADVANTAGES—

Exceptional efficiency (see Bulletin for performance curves) plus extreme simplicity make this an ideal pump for corrosive applications. High interchangeability of parts cuts stocking problem. Quick inspection or cleaning—simply remove casing cover without disturbing pipe connections.

MEMBER

Write for Bulletin 725.3 for complete details on this new stainless steel pump.

Goulds PUMPS INC. Seneca Falls New York

For more data on these items, use post cards, p192a. Identify request with P and number.

barrels. Cradle and supporting base are structural steel with all members riveted or welded. A safety air-vent pouring spout insures even flow of liquid without spurts or splashes. Flow capacity is 5 gal per min.

General Scientific Equip Co, 2700 W Huntingdon St, Philadelphia 32, Pa.

COMPRESSED-AIR SEPARATOR P104

In seven inlet and outlet tapping sizes from ½ to 2½ in., these separators clean compressed air by centrifugal force. Moisture, oil, scale and other solids in the air are whirled outward to walls of unit where they drain to trap section. Clean air passes to device served. Float-operated trap automatically releases accumulated liquids as they rise to a level above that needed to effect a seal. Drain-valve outlet is tapered to prevent stoppage by particles of scale and other materials.

The Swartwout Co, 18511 Euclid Ave, Cleveland 12, Ohio

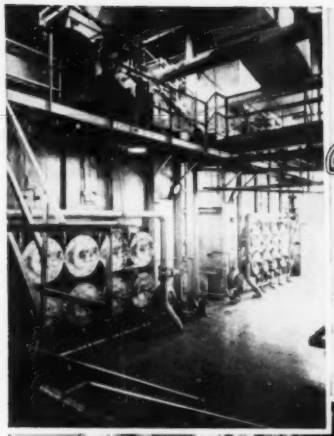
AIR-OPERATED CONTROLLER P150

Sensitive, precise, fast-operating controller works from air pressure and can be combined with flowmeters, temperature, pressure and level recorders to give automatic control of process within close limits.

Penn Industrial Instrument Corp, 3116 N. Seventeenth St, Philadelphia 32, Pa.

ELECTRONIC CONTROLLER P151

A line of instruments known as the *Cabinet Series* designed to incorporate auxiliary equipment into the case of a direct-reading controller. These instruments

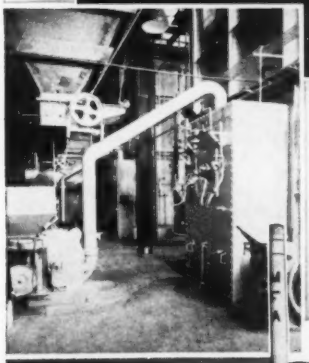


10 UNION
Steam Generators at
Producers Creamery Co.

• SPRINGFIELD • MONETT • LEBANON
• ELDORADO SPRINGS, MO.

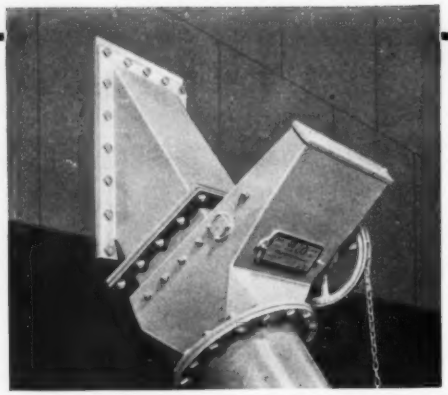
1st Choice for 16 Years

1934–2 Union "L" Type 265 HP Springfield
1940–1 Union "L" Type 265 HP Springfield
1945–1 Union "H" Type 533 HP Springfield
1946–2 Union "H" Type 603 HP Monett
1946–2 Union "H" Type 323 HP Lebanon
1946–2 Union "H" Type 323 HP Eldorado Springs



HERE is a running account of Union Boiler installations in 4 milk plants of Producers Creamery Company, Springfield, Mo.—an area believed to be the heaviest milk producer in the United States. Producers in 1928 at Springfield, Mo. handled only 100,000 pounds of milk per day for 1000 farmer patrons. Today, they operate milk plants at Springfield, Monett, Lebanon and Eldorado Springs, Mo. with a combined capacity of 2,150,000 pounds of milk daily for some 10,000 patrons. An official of this company says "Having had experience with the two Union Boilers installed in the Springfield plant in 1934, we purchased eight more of them for Springfield and the three new plants. This should give anyone a pretty good idea of our opinion of Union Boilers." Union Boilers, once introduced, are "practical Economists" on any cost sheet. Consult with Union engineers before you select steam generating equipment. More than a half century of boiler design and construction will go to work for you.

UNION IRON WORKS . . . *Since 1890*
373 CASCADE STREET • ERIE, PENNA.
BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL



S-E-CO. COAL VALVES are equipped with a poke hole which enables operators to free coal that may stick at the bunker outlet. The poke hole also enables operators to inspect the inside of the valve. These poke holes are equipped with gasketed covers which make them dust-tight.

Write for bulletin.

STOCK EQUIPMENT COMPANY

715P Hanna Building ★ Cleveland 15, Ohio

LOOK here for

ANSWERS

to Tomorrow's NEW PROBLEMS

Now that priorities, allocations, cut-backs, and other essential restrictions have returned to the industrial scene, the heating, ventilating, and air conditioning picture is certain to undergo significant changes in the days to come—to pose new problems for plant officials, architects, engineers, and operating personnel. That is why attendance at this foremost Exposition of its kind—largest ever staged—takes on greater importance and timeliness than ever. The wealth of first-hand information available here on latest developments, newest trends, available equipment and supplies, and sources of supply, may prove to be an invaluable business asset for the uncertain times ahead.

Over 300 exhibitors with their technical representatives will be on hand to show and tell what the future offers for heating, ventilating and air conditioning in all types of commercial and public buildings, industrial plants, and homes. In no other way can so many helpful ideas and valuable contacts be obtained, and so much equipment seen and compared in so little time . . . all so essential to solving tomorrow's new problems.

So plan now to take advantage of this big opportunity. Note the dates.

Auspices of the American Society of Heating & Ventilating Engineers

MANAGEMENT INTERNATIONAL EXPOSITION COMPANY

For more data on these items, use post cards, p192a. Identify request with P and number.

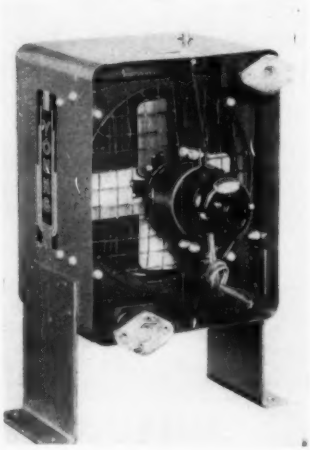
are used for measurement, indication, and automatic control of temperature, speed, flow, pressure, etc, including voltage and current.

Wheelco Instruments Co, Chicago 7.

THREAD RESTORER **P132**

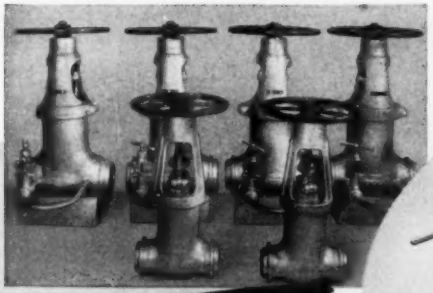
Closely spaced studs and bolts that are battered, distorted or rusted can be readily renewed with adjustable cutting-jaw-type thread restorer. Unit has swing of only 2 5/16 in. and its adjustable jaws can be fitted by a twist of the handle to any male thread of ¼ to 1 in. root diameter, either right or left hand.

Buckingham Mfg Co, Inc, Binghamton, N.Y.

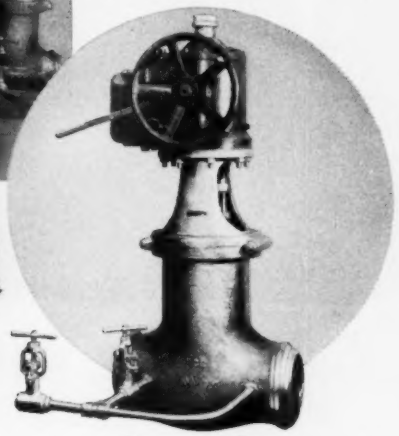


UNIT HEATER **P111**

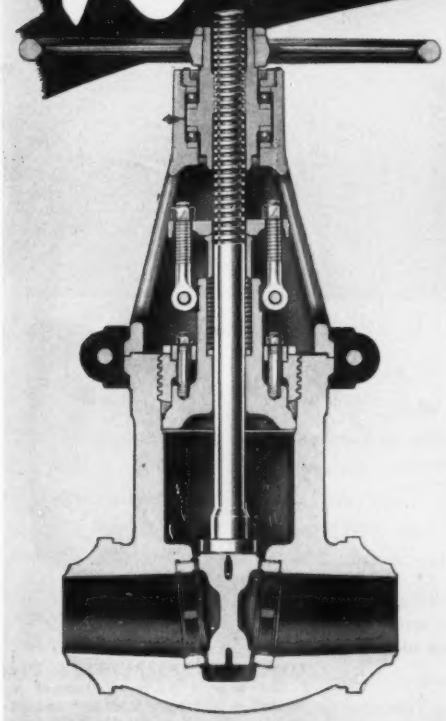
Compact 16x13x17-in. unit heater, for locomotive cabssmall buildings, storage sheds. Uses either steam or hot water and



INSTALLED in South Carolina Power Company's Plant Hagood, No. 2 Unit, at Charleston, S. C.



R·P&C



Pressure Seal Bonnet

THESE CAST STEEL gate, globe and angle valves, for use especially in high pressure, high temperature steam service, are being used increasingly for less difficult services. They offer these advantages:

1. Elimination of bonnet flanges, bolts and gaskets.
2. Tightness unaffected by temperature changes.
3. No need to restress bolting to maintain tight joint.
4. Disassembly and reassembly greatly simplified, should inspection be required.
5. Greatly reduced weight without loss of strength. Less space required. Erection simplified.
6. Insulation is facilitated and neater appearance is given to installation.

FOR COMPLETE INFORMATION, get in touch with our District Office nearest you.

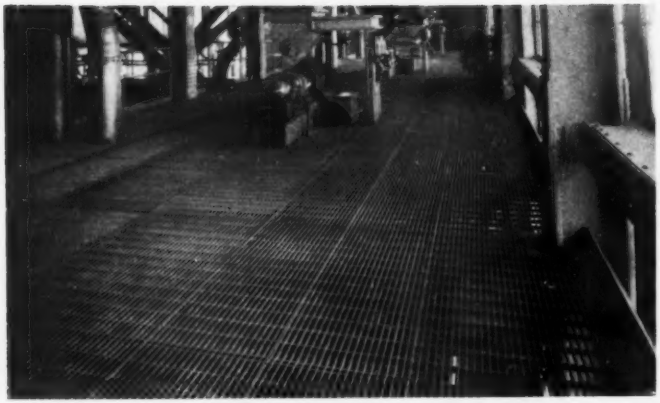
ACCO

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

TRADE MARK

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

READING-PRATT & CADY VALVES



Outstanding Advantages

of Hendrick Open Steel Flooring

- 90% open area for light and ventilation.
- Made in integral panels, under hundreds of tons of hydraulic pressure, it will support heavy loading without any lateral deflection of bars.
- Its rectangular, square-edge steel bars provide a safe, non-slipping, level walking surface.
- It has no bolts, rivets or angle irons to loosen, or to collect dirt and refuse.
- It has no welds, with residual stresses that lead to warping.

Hendrick Shur-Site Treads

For stairs, ladders and fire escapes, Shur-Site Treads offer all the advantages of Mitco construction.

A heavy flanged nosing bar that gives sharp visibility to the edge of each tread is a valuable safety feature. It also provides additional strength where the load is greatest.

Hendrick Mitco Armorgrids

For floors, loading platforms, ramps and driveways that have to withstand heavy traffic, Hendrick Armorgrids are unequaled. They do not depend on the fill for development of full strength to resist shock loads.

Write for Catalogue of Hendrick Mitco Products

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Manufacturing Company

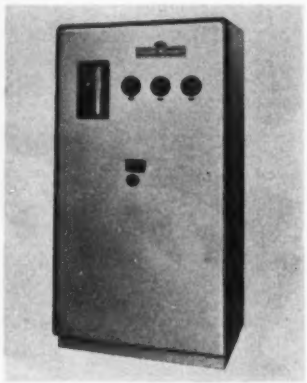
Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

For more data on these items, use post cards, p192a. Identify request with P and number.

is ideal for waste heat from heated jacket water of gas, gasoline or diesel engines.
Young Radiator Co, Racine, Wis.



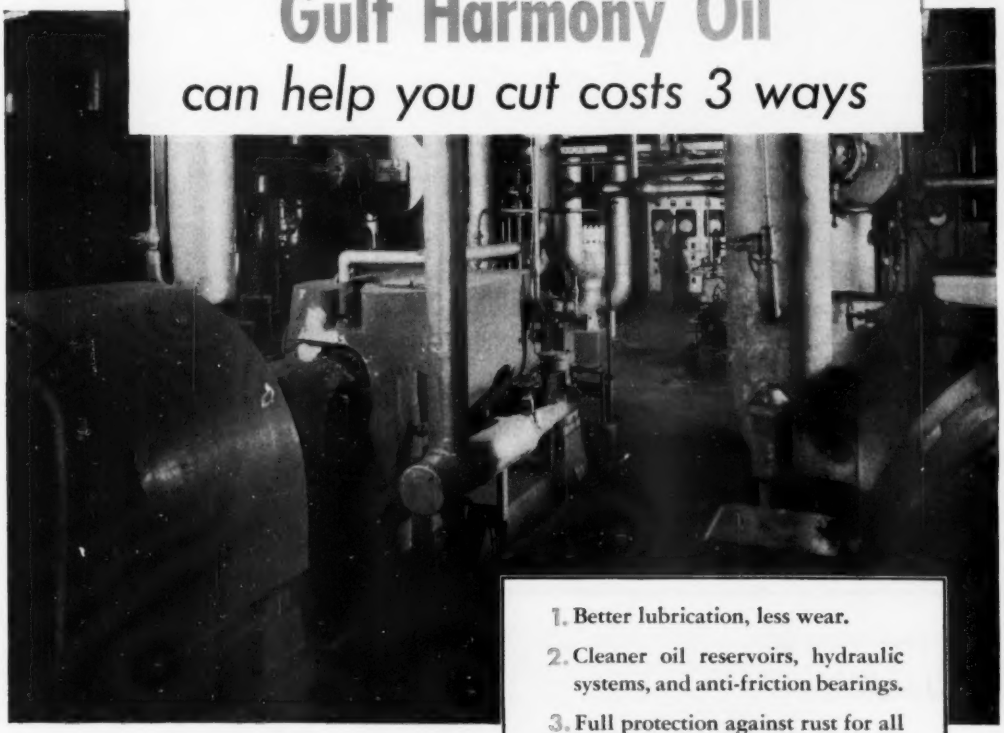
CHLORINIZER **P118**
Visible gas flow, automatic control of feed rate and sequence of point of application are features of the *HCVS* high-capacity chlorinizer. Unit is a simplified apparatus for metering and control of chlorine gas-feed by manual, semi-automatic or automatic proportional means for control of slimes in power-plant cooling-water systems.
Builders-Providence, Inc, 345 Harris Ave, Providence 1, R.I.

LONG-SCALE INSTRUMENTS **P142**
This line of 8¾-in. instruments are designated as types AB-16 (ac) and DB-16 (dc). They have 250-deg scales which are 14.2 in. long.
General Electric Co, Schenectady, N.Y.

PYROMETER CONTROLLER **P152**
Anticipatory voltage developed by the *Capaciline*, Model 252 P, fed into the electronic-control circuit of the manufacturer's standard *Capacitrol* helps maintain a uni-

For pumps, compressors, and other oil-lubricated auxiliary equipment

Gulf Harmony Oil
can help you cut costs 3 ways



1. Better lubrication, less wear.
2. Cleaner oil reservoirs, hydraulic systems, and anti-friction bearings.
3. Full protection against rust for all oil-bathed surfaces.

Gulf Harmony Oil provides the kind of protection that means lower maintenance costs and freedom from lubrication troubles. Users report that it is the best lubricant they have ever used for pumps, compressors, blowers, and other oil-lubricated plant equipment. They also report excellent performance in hydraulic applications.

Because of outstanding oxidation stability, Gulf Harmony Oil has exceptional resistance to sludging, keeps bearings and lubricating systems clean.

Gulf Harmony Oil has been fortified to provide an effective rust preventive film. Now you can be sure of full protection against rust for all oil-bathed surfaces. It is particularly effective for ball and roller bearings operating under wet conditions. And it separates readily from water.

This outstanding oil provides more effective protection for bearings, gear units, hydraulic mechanisms and compressor cylinders. Available in a wide range of viscosities.

For complete information on Gulf Harmony Oil, call in a Gulf Lubrication Engineer today.

Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh, Pennsylvania.

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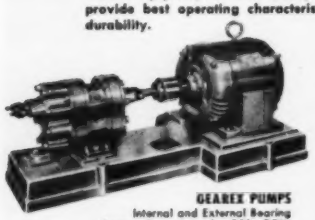
Pumping Costs Go Down When Pump Quality Goes Up

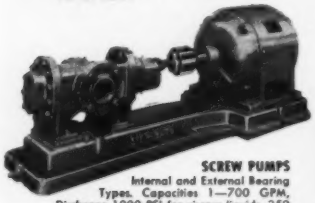
Sier-Bath ROTARY PUMPS

The surest way to cut pumping costs is by specifying the best pumps you can find. Then—day after day—your power or process installation will run at top efficiency, with smallest chance of costly interruption, and lowest cost for pump maintenance and replacement.

★ **Point by point, Sier-Bath Rotary Pumps are designed and constructed to provide best operating characteristics, lowest maintenance, and greatest durability.**



GEAREX PUMPS
Internal and External Bearing
Types. Capacities 1—550 GPM. Discharge 250 PSI for viscous liquids, 50 PSI for water.



SCREW PUMPS
Internal and External Bearing
Types. Capacities 1—700 GPM. Discharge 1000 PSI for viscous liquids, 250 PSI for water.

★ **No Metallic Contact Between Rotors**—sustains high volumetric efficiency.

★ **Precision Cut Timing Gears**—maintain exact rotor clearance.

★ **High Volumetric Efficiency**—reduces wear caused by erosion.

★ **Low Pressure on Stuffing Boxes**—reduces leakage, adds to packing life.

★ **Long Life**—husky shafts, rotors—high load capacity bearings, deep stuffing boxes.

★ **Direct Connected Up to 1800 RPM.**

Available in corrosion resistant alloys, horizontal or vertical construction. Special bodies, stuffing boxes, bearings for high temperature applications.

WRITE FOR LITERATURE

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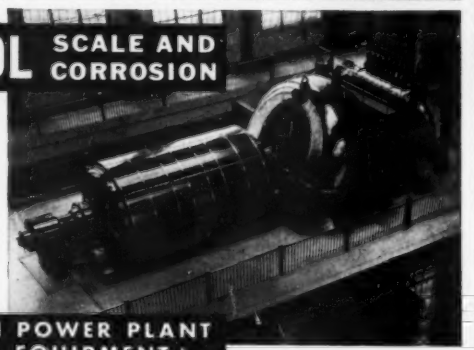
Sier-Bath GEAR and PUMP CO., Inc.

9254 HUDSON BLVD., NORTH BERGEN, N. J.

CONTROL SCALE AND CORROSION IN POWER PLANT EQUIPMENT



Control scale and corrosion in boilers, steam and condensate lines, water jackets, condensers — wherever water is used with WRIGHT WATER-CONDITIONING CHEMICALS.

There is a Wright Field Engineer near you who will help with your water conditioning problems.

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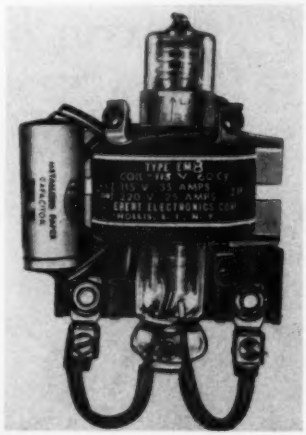
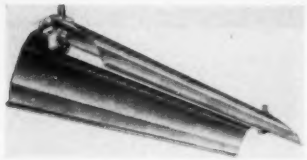
form condition within a heat-treating or process furnace at a relatively low cost.
Wheelco Instruments Co, Chicago 7, Ill.



MERCURY RELAY **P134**

Relay's energizing coil is in a resonant circuit. Hence external operating contact need carry only enough power to detune the circuit (about 8 ma, ac at 100 v). Relay is rated at 35 amp, 115 v; 30 amp, 220 v; 20 amp, 440 v.
Ebert Electronics Corp, 185-09 Jamaica Ave, Hollis 7, Long Island, N.Y.



MERCURY-LAMP REFLECTOR P135

High-bay 3-kw reflector provides 55-deg crosswise shielding. Fixture has lampholders, drop-guards and wire connection boxes, with heavy-duty hanging loops.
The Edwin F Guth Co, 2615 Washington Ave, St. Louis 3, Mo.

SOLDERING TOOL **P153**

Portable "Standard," 1000-watt *Thermo-Grip* soldering tool operates on the resistance-heating principle. As soon as the tool touches the work, the secondary power circuit is completed and heating begins.
Ideal Industries, Inc, 1025 Park Ave, Sycamore, Ill.

We Slipped Up . . .

. . . on the manufacturer's name for the *Oil-Mist Lubrication*, New Equipment item that appeared on page 146 of the December issue. It should have been
Alemite Division of Stewart-Warner Corp, 1826 Diversey Pkwy, Chicago 14, Ill.

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

BOILERS AND AUXILIARIES

B25 SOOT BLOWERS—24-page bulletin No. 604 presents a few outstanding Vulcan automatic sequential soot blower installations in central stations. Reports from operators and production departments are listed. Vulcan Soot Blower Div, Continental Foundry & Machine Co, DuBois, Pa.

B26 PLASTIC FIRE BRICK—44-page booklet, entitled "The Inside Story of Plastic Fire Brick," consists of advantages, applications, specifications, specialties and engineering data on plastic firebrick. Ladish-Christy Co, 2400 Forbes St, Pittsburgh, 19, Pa.

B27 COAL CRUSHER—4-page leaflet features the Gundlach "Two-Stage" coal crusher which incorporates two crushing stages in one machine and is designed to reduce run-of-mine coal to stoker coal in one operation. W J Gundlach Machine Co, Belleville, Ill.

B28 ASH AND FLYASH HANDLING — 24-page publication gives detailed information on both hydraulic and pneumatic ash and flyash handling systems. Compiled in question and answer form, the booklet discusses elements and advantages of the various systems. Beaumont Birch Co, 1005 Race St, Philadelphia 2, Pa.

B29 STEAM PROTECTOR — Circular presents the National seam protector, a refractory tile attachable to sets to seams of riveted HRT boilers to insulate lapped edges of plates from fire-cracking and oxidation. National Boiler Protector Co, 939 Keteltt Bldg, Dayton 2, Ohio.

B30 MECHANICAL DRAFT FANS —20-page catalog No. 168 contains an extensive line of mechanical draft fans for both forced and induced draft service. Details of construction, drive arrangements and mounting methods, also several performance curves are included. Green Fuel Economizer Co, Inc, Beacon, N. Y.

B31 STEAM BOILER UNIT—8-page bulletin No. 647 features complete, fully automatic, factory-built steam boiler unit. Illustrations, specifications and dimension data are given. Typical boiler installations are also shown. Johnston Brothers Inc, Ferrysburg, Mich.

CONTROLS, ELECTRIC

D6 MOTOR CONTROL—4-page brochure No. 656 discusses the ideal wound-rotor induction motor control for centrifugal compressor drives. One line and functional diagram is shown. Engineering data and description are also furnished. Ideal Electric & Mfg Co, Mansfield, Ohio.

D7 MERCURY RELAYS — 4-page folder illustrates and lists the firm's line of heavy-duty 1-, 2- and 3-pole mercury plunger relays and sensitive relays. Contains prices, relay hook-ups and dimensional diagrams. Short Electronics Corp, 225-06 Jamaica Ave, Hollis 7, N. Y.

CONTROLS, MECHANICAL

E12 RATIO TOTALIZER — 8-page publication No. 5455 describes and illustrates 12 suggested applications of the Hagan ratio totalizer, a pneumatically operated control mechanism for accurately combining input

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Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

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control pressures and spring forces to produce a single output control pressure. Magnus Corp, Hagan Bldg, Pittsburgh 30, Pa.

E13 **HOT WATER CONTROLS**—8-page bulletin No. P-8157-1 contains comprehensive design data that facilitates the selection of automatic temperature controls for hot water heating systems. Barber-Colman Co, Rockford, Ill.

ELECTRICAL EQUIPMENT

F41 **SWITCHGEAR**—20-page booklet No. 13E6188A covers all types of Allis-Chalmers switchgear, indoor or outdoor, with removable or stationary circuit breakers; switchboards of all types; "Ruptair" replacement units; and small-circuit, single-circuit and load center unit substations. Allis-Chalmers Mfg Co, 945 S 70th St, Milwaukee, Wis.

F42 **DISCONNECTING SWITCHES**—8-page bulletin No. B-4716 contains the Company's complete line of indoor and outdoor air-disconnecting switches. High lights on design and operation of these switches, as well as application information to simplify selection, are included. Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa.

F43 **SYNCHRONOUS MOTORS**—4-page folder No. 44-900 describes the firm's expanded line of low-speed synchronous motors. They are available in ratings 20 hp and larger—450 rpm and below—with bracket, pedestal or engine-type construction. Electric Products Co, 1765 Clarkstone Rd, Cleveland 12, Ohio.

F44 **SOLDERLESS CONNECTORS**—6-page brochure No. 714 furnishes detailed descriptive data, installation instructions and ordering information on Buchanan "pres-Sure connectors" for soldering, splicing and terminating of electrical wires. Buchanan Electrical Products Corp, 1280 Central Ave, Hillside, N. J.

F45 **DRY-TYPE TRANSFORMERS**—32-page booklet No. B-4428 shows reasons why dry-type transformers are safer and less expensive to install and maintain in industrial plants, mines, utilities, etc. Types of air-cooled transformers for every use are also illustrated. Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa.

F46 **MOTORS AND GENERATORS**—12-page catalog No. 506 presents features of medium- and high-speed Ideal synchronous motors and generators. Engineering information and data are included. Ideal Electric & Mfg Co, Mansfield, Ohio.

F47 **SELF-LUBRICATED MOTORS**—4-page folder No. 1570 discusses the company's Lubrifloat principle in electrical motors, showing how bearings can be lubricated for life and also can be purged of old lubricant and renewed without disturbing the bearing housing. U. S. Electrical Motors Inc, 1600 E Slauson Ave, Los Angeles 54, Calif.

MAINTENANCE AND SAFETY EQUIPMENT

K28 **OIL FILTERS**—8-page brochure covers Kinkhorn-Smith line of industrial and marine filters including the following 3 types: The Refiner, designed for extremely fine filtration and for removal of both emulsified and free oil from condensate; the Standard water filter and grease extractor for general service where emulsified oil is not present in the condensate. Blackburn-Smith Mfg Co, Ltd, 96 River St, Hoboken, N. J.

★ **VAPOR PURIFIERS**—6-page engineering manual for selection of high efficiency purifiers for vapor, steam, gas and air applications. Contains formulas used to calculate volume, actual flow, velocity, and pressure drop. Centrifix Corp, 3423 Payne Ave, Cleveland 14, Ohio. (*Write direct to manufacturer on company stationery giving name and title.)

MAINTENANCE MATERIALS

L32 **HIGH TEMPERATURE LUBRICANTS**—4-page folder, entitled "Hi-Temp Oils," completely describes the testing procedure used by Houghton's research staff in setting up a series of Hi-Temp oils to meet all high temperature conditions up to and even over 500 deg. E F Houghton & Co, 305 W Lehigh Ave, Philadelphia 32, Pa.

★ **PACKINGS**—36-page catalog No. PC-101 covers Palmetto self-lubricating, molded and sheet packings, both standard and special. Text points up application, structure and performance of each individual packing. Greene, Tweed & Co, North Wales, Pa. (*Write direct to manufacturer on company stationery giving name and title.)

L33 **LOCKNUTS**—6-page brochure illustrates several types of self-locking stop nuts. Outstanding features are listed. Elastic Stop Nut Corp of America, 2330 Vauxhall Rd, Union, N. J.

L34 **BEARING GREASES**—Folder contains the firm's full line of Lubriko greases for anti-friction bearings. Uses and application data for 25 different densities ranging from liquid greases to heavy cup lubricants are given. Master Lubricants Co, Meadow & Jackson Sts, Philadelphia, Pa.

L38 **ANTI-CORROSION COATING**—2-page leaflet No. 103 tells about Elastite, a one-coat, self-protecting, anti-corrosion zinc coating. Data on surface preparation, methods of application, and case histories are given. Industrial Metal Protectives Inc, 601 Homestead Ave, Dayton 2, Ohio.

★ **HYDRAULIC OILS**—44-page Kendall Bulletin No. D-4 covers fundamental information on hydraulic systems, maintenance, trouble-shooting, and selection of proper fluids. Specially prepared phantom and cutaway drawings illustrate functions of basic types of valves, pumps, hydraulic motors, torque converters, etc. Sun Oil Co, Philadelphia 3, Pa. (*Write direct to manufacturer on company stationery giving name and title.)

L36 **PROTECTIVE COATING**—Data sheet No. C-21 describes Chlorofad, a rubber-base protective coating. Advantages, applications and prices are given. Carboline Co, 1645 Forsythe Blvd, St. Louis 5, Mo.

★ **MECHANICAL PACKINGS**—12-page catalog features Pierrock mechanical packings, including the Pierrock process packing which is self-forming, self-lubricating, and self-sealing. Recommendation chart and illustrations are given. Pierrock Co, Packing Div, 30th & Filbert Sts, Philadelphia 4, Pa. (*Write direct to manufacturer on company stationery giving name and title.)

(Continued on page 204)

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HOW SUPERIOR'S 4-pass design gives you . . .

Taper Tube EFFICIENCY

The long-lived efficiency of Superior Steam Generators results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

WHY 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee **more** than 80% thermal efficiency **under field operating conditions.**

Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

Write today for the details in Catalog 301.

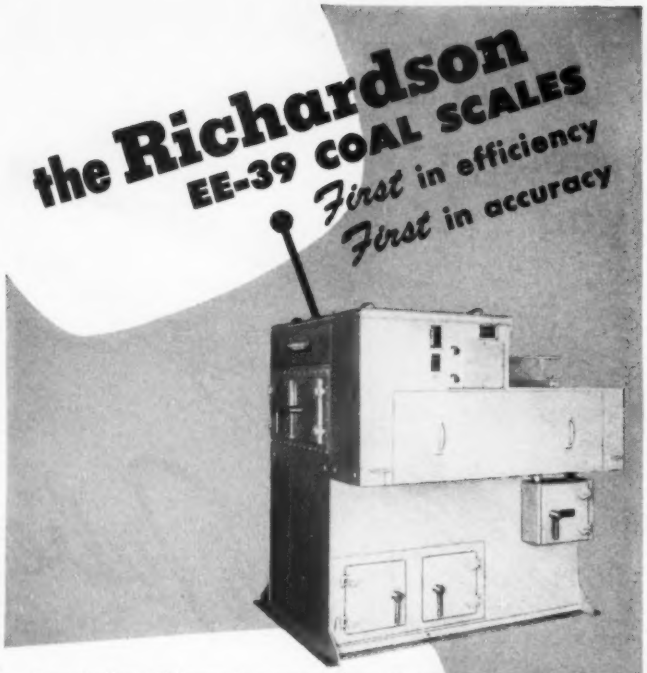
Superior Combustion Industries, inc.

Factory, Emmaus, Pa.

Executive Offices, Times Tower, Times Square, New York 18, N. Y.

the Richardson EE-39 COAL SCALES

First in efficiency
First in accuracy



Low boiler efficiency is a money hog. It can be stopped almost before it starts—with a Richardson EE-39 Coal Scale. Here are some of the reasons the EE-39 should be your first consideration. Compare them with any other scale *BEFORE* you buy.

- **A 20" x 20" inlet opening, biggest of any coal scale assures positive coal flow—no "hanging-up."**
- **Simple-to-operate by-pass mechanism, enabling coal to be re-routed to stoker or pulverizer.**
- **Pivoted leveling plate provides shallow, even coal flow, uniform "breakaway." Eliminates power or belt strain when occasional lumps pass through.**
- **Warp and twist-free weigh beam of heavy, welded members, mounted on hardened steel knife edges.**
- **Pressure-tight access doors located to provide easy inspection of weighing chamber.**

PLUS —a complete line of accessories such as "Monorate" distributor, discharge counter, remote by-pass control, etc.

For complete information write now to Richardson Scale Co., Clifton, N. J. for Bulletin 0150.

Ask a Richardson engineer to survey your present methods of checking fuel consumption and boiler efficiency. His recommendations will be based on almost 50 years of materials handling by weight experience. No obligation, of course.

7488

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Clifton, New Jersey

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MATERIALS HANDLING BY WEIGHT SINCE 1901

MATERIALS HANDLING

M16 **CONVEYOR SYSTEMS**—8-page bulletin consists of ash, mechanical, and pneumatic conveyors: Chip-Veyors; furnace doors; rotary feeders; etc. Diagrams and advantages are included. National Conveyors Co, Inc, 50 Church St, New York 7, N. Y.

★ **PASSENGER ELEVATORS** — 56-page buyer's guide for passenger elevators consists of the following information: Component parts; types of control; selection; budget price data; layouts; installations; modernization; and protective maintenance. Westinghouse Elec Corp, Elevator Div, Jersey City, N.J. (*Write direct to manufacturer on company stationery giving name and title.)

M17 **SINGLE-DRUM HOIST** — 16-page booklet No. 76-X describes the complete line of Joy single-drum, multi-purpose hoists for mines, construction jobs, oil fields, and industrial plants. A handy Select-O-Hoist chart simplifies the choice of any hoist to fill a particular need. Joy Mfg Co, Oliver Bldg, Pittsburgh 22, Pa.

M18 **VIBRATING SCREENS** — 12-page book No. 2354 gives informative data on Link-Belt CA concentric action vibrating screens for medium- and heavy-duty service. Accurate sizing, thorough rinsing and rapid dewatering of a wide range of materials ranging from ashes to zinc ore can be accomplished. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

M19 **ASH HANDLING SYSTEMS**—12-page bulletin No. 650 explains the company's hydraulic ash handling systems and pneumatic systems. Diagrams and a partial list of installations are given. Hydro-Ash Corp, 1408 W Harrison St, Chicago 7, Ill.

MECHANICAL TRANSMISSION

N20 **SPEED REDUCER** — 16-page catalog No. 3110 provides selection information, dimensions, rating tables and service factors on Falk's new all-steel right-angle Motoreducer. Falk Corp, 3001 W Canal St, Milwaukee 8, Wis.

N21 **TRANSMISSION BELTING**—8-page folder No. 3678 contains complete formulae, charts, and tables for the proper selection of transmission belting. Thermoid Co, Trenton, N. J.

METERS AND INSTRUMENTS, ELECTRIC

S5 **SMOKE INDICATOR** — 4-page data sheet No. 10.14-4 tells how smoke prevention plus combustion control cut fuel costs. Shows equipment required, installation and operation. Minneapolis - Honeywell Regulator Co, Industrial Div, Philadelphia 44, Pa.

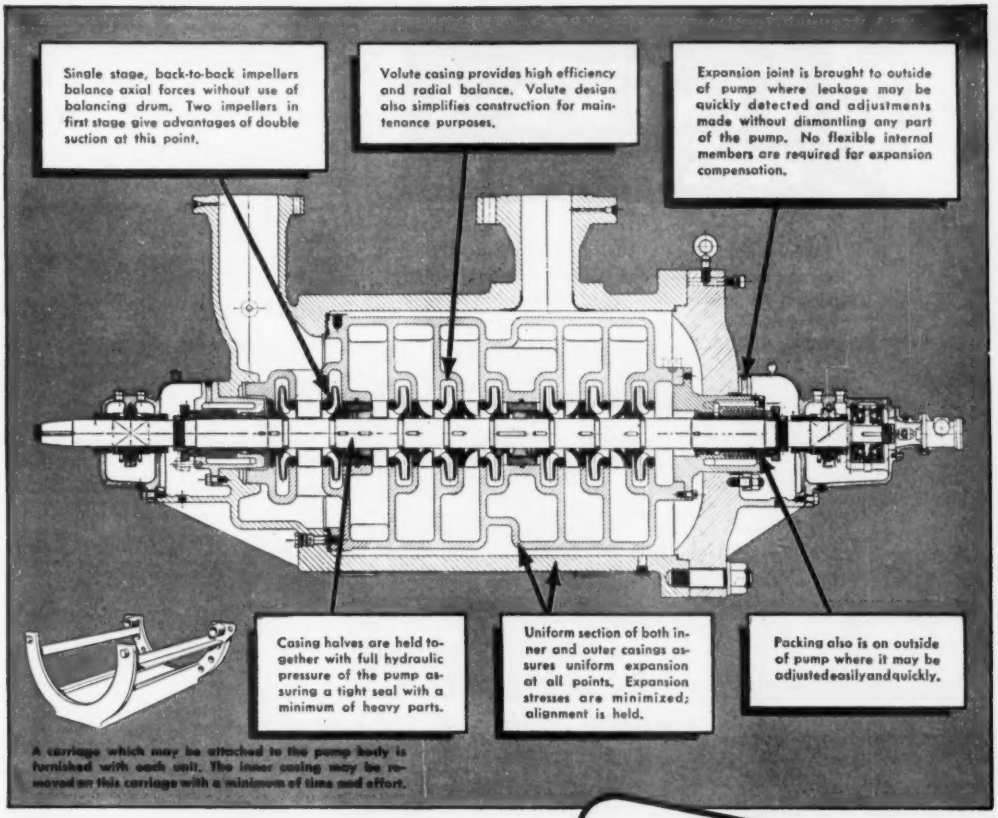
S6 **ELECTRIC INSTRUMENTS** — 4-page leaflet No. Z6600 illustrates and briefly describes a selection of typical Wheelco indicators, controllers and combustion safeguards. Price list is also given. Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.

S7 **INSULATION TESTERS**—2 bulletins are offered. One features ac and dc insulation testers. The other presents a large, long-scale, spot-of-light pointer-type instrument and single-range and multi-range electrostatic voltmeters. Cole Instrument Co, 1320 S Grand Ave, Los Angeles 15, Calif.

S8 **VOLT-AMMETER**—16-page manual No. 110 relates how the Amprobe, a pocket-size snap-on volt-ammeter, can save time and trouble, and also explains how to use it and how to read the scales. Pyramid Instrument Corp, 49 Howard St, New York 13, N. Y.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U39 **BLOW-OFF VALVES**—24-page booklet No. B-433 discusses blow-off valves for high-pressure boilers. Construction details, materials specifications, dimensions, and list prices are given. Yarnall-Waring Co, Mermaid Lane, Philadelphia 18, Pa.


Single stage, back-to-back impellers balance axial forces without use of balancing drum. Two impellers in first stage give advantages of double suction at this point.
Volute casing provides high efficiency and radial balance. Volute design also simplifies construction for maintenance purposes.
Expansion joint is brought to outside of pump where leakage may be quickly detected and adjustments made without dismantling any part of the pump. No flexible internal members are required for expansion compensation.
Casing halves are held together with full hydraulic pressure of the pump assuring a tight seal with a minimum of heavy parts.
Uniform section of both inner and outer casings assures uniform expansion at all points. Expansion stresses are minimized; alignment is held.
Packing also is on outside of pump where it may be adjusted easily and quickly.
A carriage which may be attached to the pump body is furnished with each unit. The inner casing may be removed on this carriage with a minimum of time and effort.

Cost Cutting Features

ALLIS-CHALMERS

NEW BOILER FEED PUMP

HERE IS A PUMP designed to meet the needs of the newer high pressure boiler plants. Efficiency is high, maintenance is low and every design feature has a long record of successful application to boiler feed service.

Sizes range from 1200 to 2500 psig and from 300 to 2000 gpm. Allis-Chalmers can supply the complete boiler feed pump installation including pump, motor and control, of coordinated design and manufacture.

Get the details on this new boiler feed pump from your Allis-Chalmers Sales Office or write Allis-Chalmers, Milwaukee 1, Wisconsin

A-3250

ALLIS-CHALMERS

YOU CAN'T BEAT
VIKING'S
COMPLETE LINE OF
ROTARY PUMPS

"In all my experience of buying rotary pumps, I never saw the equal of the range in size and style of Viking pumps. No matter what I need, there seems to be a Viking built just for that purpose." So says one man looking for the answer to his rotary pump problems.

Don't forget, the next time you need rotary pumps, see Viking first. Check the complete line.

For a good start, ask for free bulletin 51SW today.

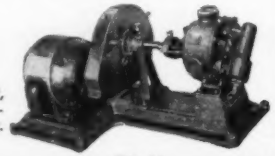
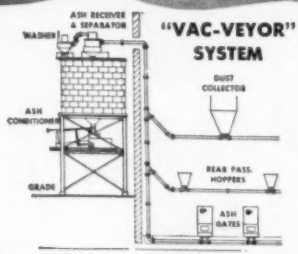


Fig 12

See Our Catalog In SWEETS

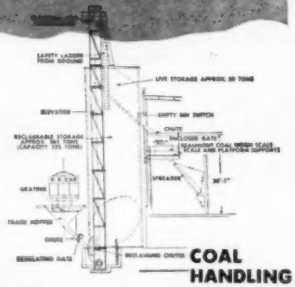
Viking PUMP COMPANY
Cedar Falls, Iowa

Profits Saved AT EVERY STAGE
. . . WITH BEAUMONT
COAL & ASH HANDLING EQUIPMENT



"VAC-VEYOR" SYSTEM

In this system, ashes, siftings, soot and dust are conveyed by pipe from the ash pits, dust collectors, stack, etc., to an ash receiver and separator at the top side of a silo—by means of a vacuum. One man operates the system, keeping your plant cleaner with less labor. Send for Catalog.



COAL HANDLING

Coal arrives by rail, is dumped into hopper, raised by bucket elevator and discharged either into bunker for immediate use or down chute to yard storage. One operator controls all equipment. Send for Catalog.

BEAUMONT BIRCH Company
1502 RACE STREET—PHILADELPHIA 2, PENNA.
Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

U40 **SOLENOID VALVES** — 4-page bulletin No. 8262-8314 describes 2- and 3-way midget-size packless solenoid valves for air, gas, water, light oil, refrigerants, and other fluids. Flow data and list prices are included. American Switch Co, Orange, N. J.

U41 **STEAM TRAPS**—4-page folder No. 550 contains specifications, capacities, sizes, pressures, weights and list prices of all principal types of Super-Silvertop steam traps. V D Anderson Co, 1934 W 96th St, Cleveland 2, Ohio.

U42 **VALVES AND FITTINGS**—24-page catalog No. R-4 covers the company's complete line of refrigeration and air-conditioning valves, fittings and accessories. Superior Valve & Fittings Co, 1509 W Liberty Ave, Pittsburgh 26, Pa.

U43 **SAFETY VALVE**—8-page publication M-302 presents the Lock-Tite safety valve, designed for all types of gas combustion systems. Operation, construction details, applications, selection information, dimensions and prices are included. Eclipse Fuel Engrg Co, Rockford, Ill.

PRIME MOVERS

V5 **MOTOR-GENERATOR SETS**—8-page booklet No. GEA-5506 covers synchronous motor-generator sets from 30-8000 kw as a source of dc power for many industrial applications. Four typical installations are shown. General Electric Co, Schenectady 5, N.Y.

V6 **STEAM TURBINE UNITS**—16-page bulletin No. 03B6801A gives informative data on 6 sizes of standardized steam turbine units — 11,500, 15,000, 20,000, 30,000, 40,000 and 60,000 kw — and the recommended 90,000 kw turbine. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

V7 **DIESEL ENGINES** — 4-page folder No. 321 describes the firm's Series 600 diesel engines that have a 12¾-in. bore, 15½-in. stroke, and a speed range from 360-625 rpm. Baldwin Locomotive Works, Philadelphia 42, Pa.

V8 **DIESEL ENGINE DESIGN**—28-page booklet, entitled "10 Questions to Ask a Diesel Engine Salesman," asks and answers 10 questions pertaining to diesel engine design and gives full mechanical details. Murphy Diesel Co, 5317 W Burnham St, Milwaukee 14, Wis.

PUMPS

W20 **CONDENSER CIRCULATORS**—Catalog No. G-1050 illustrates and describes condenser circulators in standard sizes to 100,000 gpm, and in special sizes to 200,000 gpm. Designed for power station service, the pumps are vertical, mixed-flow units of large capacity and low head. Economy Pumps Inc, Hamilton, Ohio.

W21 **CENTRIFUGAL PUMP** — 12-page bulletin No. CP-749B discusses advantages of Mission centrifugal pump having streamlined flow from its concentric casing. Applications, construction details and performance curves are included. Mission Mfg Co, P O Box 4209, Houston 14, Texas.

★ **PROCESSING PUMPS** — 12-page booklet features a full line of pumps for handling corrosive and non-corrosive liquids, solids-carrying liquids and dry and semi-dry materials. Yeomans Brothers Co, 1433 N Dayton St, Chicago 22, Ill. (•Write direct to manufacturer on company stationery giving name and title.)

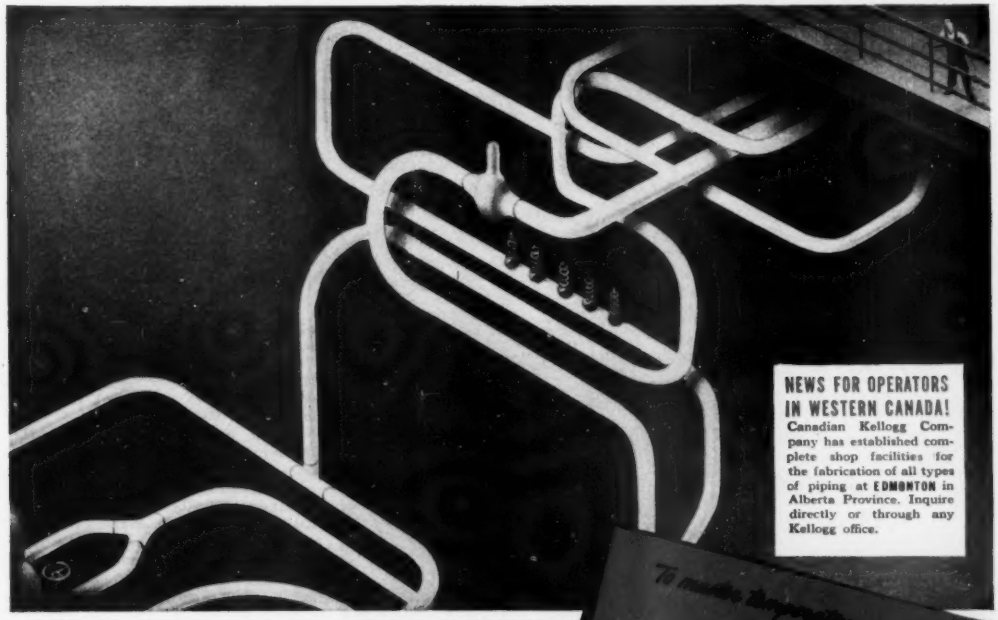
WATER TREATMENT

X19 **WATER CONDITIONING EQUIPMENT** — 4-page folder No. WS-50-14 furnishes a complete line of equipment for any purpose requiring treated water. Tells where each is used, what it does and the process. Foster Wheeler Corp, 165 Broadway, New York 6, N. Y.

X20 **FILTRATION EQUIPMENT** — 20-page catalog No. 691 illustrates and compares methods and equipment for industrial water filtration. Cutaway views, operating data and

Note: Thirteen Major Reheat Units...

. . . within a short period, we have contracted to fabricate and install the critical power piping for thirteen major reheat units. These systems are for nine leading utility companies...include designs by six well-known consulting engineers...and have a total operating capacity of more than 1,150,000 kws. In addition, Kellogg power piping has been specified for many traditional-type installations in the U.S., Canada, Europe and South America.



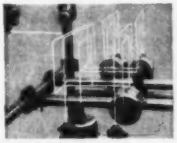
NEWS FOR OPERATORS IN WESTERN CANADA!
Canadian Kellogg Company has established complete shop facilities for the fabrication of all types of piping at **EDMONTON** in Alberta Province. Inquire directly or through any Kellogg office.

To enable temperatures, pressures and chemicals to...
M. W. KELLOGG
...piping and process equipment

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

KELLOGG
50th ANNIVERSARY
1901 - 1951



Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

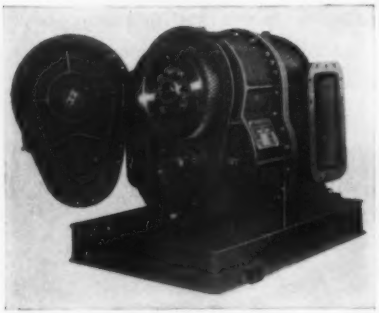
Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

Pressure Vessels
Vacuum Vessels
Fractionating Columns
Drums and Shells
Heat Exchangers
Process Piping
Bends and Headers
Giant One-Piece Bends
Forged and Welded Fittings
Radial Brick Chimneys

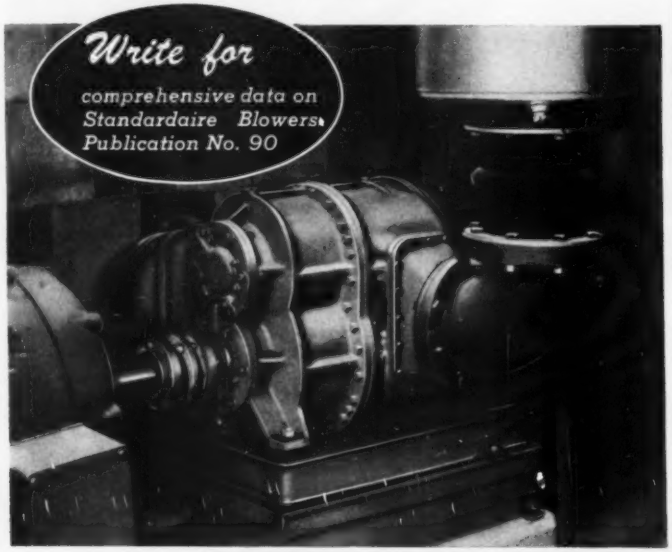
The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman Incorporated) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

The STANDARDAIRE
PRECISION BUILT
Axial Flow BLOWER ~



Here's another important design feature of the Standardaire Blower —HEAT TREATED ALLOY STEEL TIMING GEARS—generated and shaved to extreme accuracy for quiet operation.

THESE helical gears keep the cycloidal form, screw type rotors of the Standardaire Blower in timed relation. There is no wind-up in the shafts between the rotors and gears as a very small percentage of the in-put power goes through the timing gears. The male or main rotor does the work and consumes the power; the female rotor acts simply as a valve or gate—further evidence of the finer features found only in the Standardaire Blower. The Standard Stoker Co., Inc. Dept.—370 Lexington Ave., New York 17, New York.



● Typical installation of a Standardaire Blower as installed in a malting plant.

THE STANDARD STOKER CO • INC •

Standard Stoker SSC

NEW YORK • CHICAGO • ERIE • MONTREAL

piping suggestions for single and battery installations are provided. R P Adams Co Inc, 220 E Park Drive, Buffalo 17, N. Y.

OTHER EQUIPMENT

Z36 **HARDFACING ALLOYS**—20-page booklet contains detailed information on the complete line of Airco line of hardfacing alloys. Typical uses, mechanical properties, etc, are included. Air Reduction Sales Co, 60 East 42nd St, New York 17, N. Y.

Z37 **WATER COLUMNS AND GAGES** — 32-page publication No. 50 illustrates and describes Ernst water level and liquid level gages, illuminators, water columns, gage glass guards, gage glass inserts, etc. Prices are given. Ernst Water Column & Gage Co, Livingston, N. J.

Z38 **SERVICE AND REPAIR SHOPS**—4-page folder lists 83 authorized service shops of the company located in 31 states. Address, telephone number, and name of the man in charge of each service shop are included. Reliance Electric & Engrg Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio.

Z39 **HAND TORCHES** — 36-page catalog No. ADC-702 presents Airco's complete line of welding and cutting torches, outfits, tips, and accessories. Extensive charts showing correlation of tip, mixer, extension and torch contain complete data for each component part. Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y.

Largest Generator To Be Built

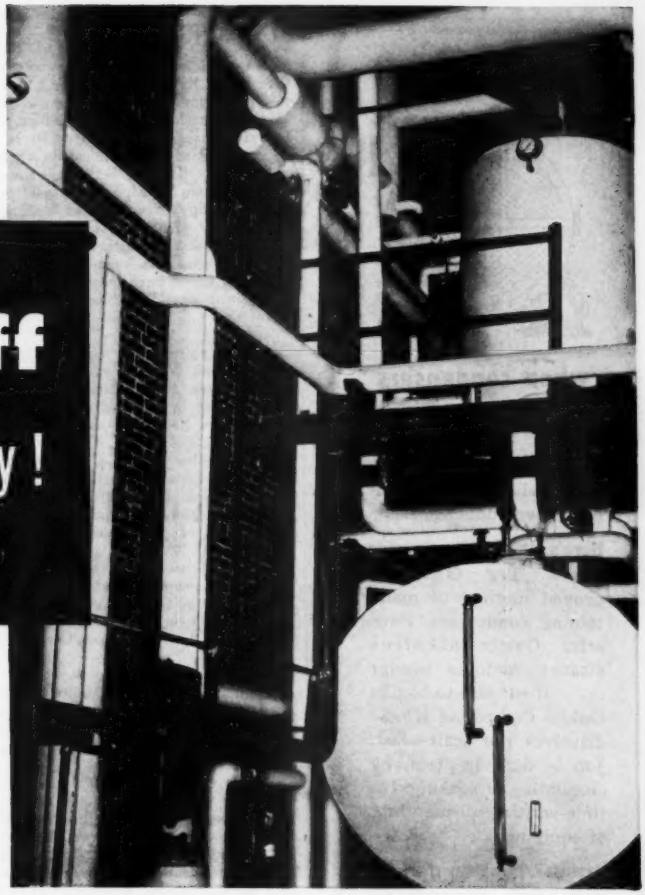
Westinghouse Electric Corp has received a contract for a 125,000-kw generator to be installed in the Delaware Station of the Philadelphia Electric Co. This will be the largest of its particular type ever built by the company and the largest yet to be installed in this country.

A new insulation called *Thermalastic* recently developed by Westinghouse will be used in the generator. This insulation consists of mica flakes embedded in tough, heat-resistant, synthetic resin with sufficient stretch at operating temperatures to expand and contract with the generator coils. Tests indicate that this new insulation has a life at least ten times as great as previous insulations.

Texas-Illinois Natural-Gas Pipeline Co has ordered 25 uniflow angle gas engines from Worthington Pump and Machinery Corp for the recently dedicated pipeline from southwestern Texas to Joliet, Ill. It will be the first time the thorough-scavenging system has been applied to pipelines gas engines.

Bureau of Mines in cooperation with private industry has worked up a new process for combined cleaning and dewatering of five sizes of coal. Various experiments have indicated a measure of success with the new method and as a result the process is nearing commercial application. Chief among the expected advantages are elimination of sludge and slurry problems, formerly associated with wet methods of coal preparation, and a reduced need for settling tanks. A free copy of *Report of Investigations 4707*, by B W Gandoud, supervising engineer, and H L Riley, assistant engineer, may be had from the Publications Distribution Section, Bureau of Mines, 4800 Forbes St, Pittsburgh.

Insulation Contractor:
Guy M. Beaty & Co.
Charlotte, N. C.



Hot stuff kept that way!

How United States Plywood Corporation conserves steam—cuts heating costs—with K & M "Featherweight"® 85% Magnesia Insulation

The production of the United States Plywood Corporation's famous *Craftsman's grade* of Weldwood Plywood calls for steam—and plenty of it. In the photo above, you see the Deaerating Feed Water Heater and the Condensate Tank in U.S. Plywood's Orangeburg, S.C., plant. And you can see how K&M "Featherweight" 85% Magnesia Insulation has been applied to these heating units, as well as to the lead lines and pipes of the steam system. Throughout this entire plant, "Featherweight" 85% Magnesia is on the job conserving steam in lines and equipment; keeping heating costs down.

K&M "Featherweight" Insulation has been doing jobs like this for more than 60 years—under every conceivable installation condition. In factories, power plants, oil refineries, chemical plants, hospitals, steamships—wherever exacting steam temperatures must be maintained—you'll find "Featherweight" 85% Magnesia.

This highly efficient insulation combines basic carbonate of magnesia with asbestos fibers—is light-weight, strong, fire-proof—time-proved for all steam temperatures up to 600° F. Ask your local Keasbey & Mattison Distributor for complete information; or, write us direct.

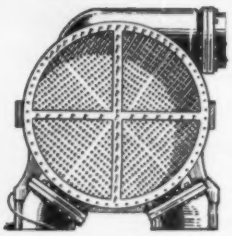
Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

K&M Best in asbestos ®

In Canada—**ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER**

You save steam



when condensers are Oakite-clean!

BTU's fly up the stack when sludge and scale bog down condensers.

Here's how to stop this waste. Try Oakite's proved method of maintaining condensers. Powerful Oakite alkaline cleaner removes sludge . . . then safe-to-handle Oakite Compound No. 32 dissolves the scale—fast. Job is done in-place, by circulating or soaking. No time-wasting dismantling of equipment.

Results? Top heat transfer with less equipment downtime, less effort—and at low cost.

Get the facts free. Call your local Oakite Technical Service Representative. Or write for *free*, illustrated digest of 71 Oakite maintenance cleaning procedures. No obligation.

OAKITE PRODUCTS, INC.
23 Thames St., N. Y. 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

APPOINTMENTS

Allis-Chalmers Mfg Co announces retirement of Richard T Stafford, assistant to W C Johnson, executive vice-president of general machinery div. In addition, the following changes are reported: Dr H K Ihrig is elected vice-president in charge of research. Kenneth R Geist succeeds Fred E Haker, retired, as director of purchases. Philip C Neumann and William C Campbell Jr are named sales representatives in Pittsburgh district office. A branch office is now open in Augusta, Me., at 269 Water St, under management of D P Appleton, with Harold S Millay as sales representative.

Eastern Steam Specialty Co, 119 Barclay St, New York, N. Y., has been chosen by **Badger Fire Extinguisher Co** as its representative in Metropolitan New York and northern New Jersey area.

C H Wheeler Mfg Co, Philadelphia, merges with Economy Pumps Inc and Klipfel Valves Inc, both of Hamilton, Ohio. No change at the present time in personnel or operation of any of the companies is planned. C H Wheeler Mfg Co operations will continue in its North Philadelphia works which comprise a series of completely equipped manufacturing shops, home offices, etc. Parent corporation of the three companies is Hamilton-Thomas Corp, Hamilton, Ohio.

A D Sheere succeeds P D Tabler, retired, as manager of **A M Byers Co's** San Francisco div. Sheere is replaced by N L Brown as manager of Houston div.

Cochrane Corp, Philadelphia, announces acquisition of Pottstown Metal Products Co, Pottstown, Pa., which will be operated as an independent subsidiary of Cochrane. T E McBride, president of Cochrane Corp, becomes president and treasurer of Pottstown Metal Products; V A Rohlin is vice-president; Raymond A Piersol is vice-president and general manager; and George Mease is plant superintendent. In addition, announcement is made of the promotion of Ervin J Bookout to general sales manager of Cochrane.

Elmer Gammeter has been made director of laboratories for **Globe Steel Tubes Co,** Milwaukee. Gammeter has succeeded Dr H K Ehrig, who has resigned to accept a position with Allis-Chalmers Co as announced above.

Dearborn Chemical Co assigns D B Bishop to its Pittsburgh office to replace J A Crenner, retired, as manager.

Martin P Kerins of Bridgeport, Conn., has been chosen Connecticut representative for **Power Chemicals Div, E F Drew & Co.** Kerins will replace Bruce Cambridge, who has been recalled to active service in the U. S. Army. Perry S Lawrence has become Southwest district manager and will be responsible for sales and service in Texas, Arkansas, Oklahoma and Louisiana.

General Electric Co announces appointments as follows: Arthur H Lauder be-

Just Out

PLUMBING

1. Covers everything from the simplest jobs of pipe fitting to the special fundamentals and techniques needed in the complicated services with which the plumber must deal today. Gives complete data on planning, installing and repairing water and gas pipes, fluid supply lines, and their drainage lines . . . and the treatment of many new problems including heating systems—pumps—automatic equipment using electricity — water softening systems — etc. **By Harold E. Babbitt. Second Ed., 644 pages, 397 illus., 299 tables, $6.50**

STEAM PLANT OPERATION

2. Second Edition of a well-known book that offers much information to help you pass power plant engineer license examinations. Explains advanced rules of stationary engineering — outlines tested methods of operating power plant equipment—and points out the responsibilities of the operating engineer relative to safe practices and efficient operation of power plants. Each chapter includes valuable lists of questions typical of those asked in license examinations. **By Everett B. Woodruff and H. B. Lammers. Second Ed., 543 pages, 244 illus. $7.00**

HANDBOOK of RIGGING

3. Condensed into this one book are tips, methods and techniques essential to more effective rigging practices in industrial and construction operations. Deals with everyday maintenance operations—with the transportation and handling of heavy machinery — and with the erection and demolition of smaller size structures. Covers everything from ropes, hoisting chains and hooks . . . to slings, ladders and hoist signals. **By W. E. Rossnagel. 321 pages, $4.75**

AMERICAN ELECTRICIANS' HANDBOOK

4. Contains hundreds of detailed descriptions, rules, methods, pictures and practical data to help you install, maintain, and operate electrical equipment. Thoroughly indexed for quick reference, it contains complete data on wires and cables, splicing, motors, capacitors—together with recent advances in electronic tubes and circuits and their applications in industry **By Terrell Croft, Revised by Clifford C. Carr. Sixth Ed., 1734 pages, 1327 illus., $7.50**

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McGRAW-HILL BOOK CO., INC.
330 W. 42nd St., New York 18, N. Y.

Send me book(s) corresponding to numbers encircled below for 10 days' examination on approval. In 10 days I will remit for books I keep, plus few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege).

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Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position P-1-51

This offer applies to U. S. only.

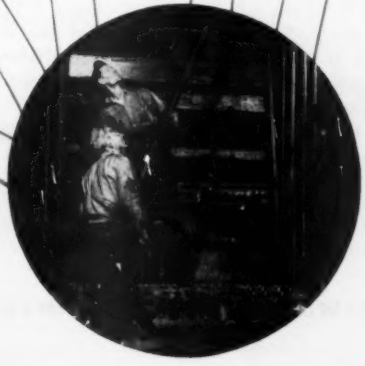
MORE REST FOR BOILER REPAIRMEN

Boilers last longer, with fewer shutdowns for repairs, when Monsanto Santosite (sodium sulfite anhydrous, technical) goes to work preventing oxygen corrosion. And boiler repairmen take it easy!

Safe, economical, easy-to-use Santosite takes *all* the dissolved oxygen out of boiler feed water, simply by combining with the oxygen to form harmless sodium sulfate. Neither Santosite nor sodium sulfate produces sludge or otherwise harms boilers and piping.

For details on the use of Santosite, supplies of which now are limited, write for a copy of Monsanto Technical Bulletin No. Q-26, "*Santosite for Removing Oxygen from Boiler Feed Water*." MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

Santosite: Reg. U. S. Pat. Off.



MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

A BETTER, FASTER WAY TO MOVE HARD-TO-HANDLE MATERIALS

THE HEWITT-ROBINS VIBRA-VEYOR® . . .
Up to 200 Feet of Pan Length on One Vibrator!

Moves anything you can't handle with a belt conveyor! Hot or cold, wet or dry, lump or pulverized, packaged or bulk . . . this Hewitt-Robins Vibra-Veyor moves it quickly, quietly, efficiently, at low cost.

Convey material up to 200 feet on one vibrating unit—horizontally . . . down-hill . . . on grades up to 10%. Save on power!

Load it to the hilt at several points along the pan, with any material. It won't bog down. Capacity is limited only by the size of the troughed pan.

Give it rough shock loads! Pan sections are supported by tough malleable iron rockers and soft coil springs—springs that counteract shock loads. The Vibra-Veyor is amazingly quiet—has a full-floating vibrating mechanism.

Install it easily! No special foundation needed, because there's no vibration in the base structure. Your own men can anchor it. Simple to maintain—only 4 points to lubricate.

Applications almost limitless! Tell us your hard-to-handle materials handling problem, and we'll build a Vibra-Veyor to solve it. Get the whole story in Bulletin 135. Write to Robins Conveyors Division, Passaic, New Jersey.

HEWITT-ROBINS
VIBRA-VEYOR

HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS *(belting and machinery)* • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

comes manager of engineering, and Joseph F Eckel, manager of the company's large motor and generator divisions at Schenectady, N Y. Lauder succeeds Earle S Henningsen, who died. Eckel replaces J M Crawford, recently transferred to Pittsfield, Mass., as manager of transformer and allied product divisions. Herbert L Ross succeeds Eckel as Lynn River works manager. In addition, industries throughout Maine and eastern New Hampshire, including pulp and paper mills, can now obtain GE insulating materials from Stultz Electric Works, 817-821 Main St, Westbrook, Me.

Engineering Products Co, Charleston, W. Va., has been made sales representative for the full line of **Eriez** magnetic separation equipment. George Garrett and Ralph Crump are members of the sales force, with F E Anderson, general manager.

Edward Valves Inc, East Chicago, Ind., has added Samuel E Bowler to its executive sales and engineering staff. He will start his contacts in the Middle Atlantic states.

In addition to their present representation of **Elgin Softener Corp** in Columbus, Ohio, territory, F H Dunk Associates have been assigned to the Cleveland territory with offices at 14820 Detroit Ave. Carl J Baum has joined the Columbus office.

Link-Belt Co, Chicago, names Bertram V Jones advertising manager, to succeed Julius S Holl, deceased. John F Kelly will continue as assistant advertising manager.

R F Attner is now manager of valve distributor sales of **Manning, Maxwell & Moore Inc,** Bridgeport, Conn.

Delbert Kay has resigned his position as advertising manager at **Nordberg Mfg Co,** Milwaukee, under a company retirement plan. Advertising duties performed by Kay have been assumed by J D Grace, manager, advertising and sales development dept.

Kaylo Div, Owens-Illinois Glass Co appoints Reilly-Benton Co, New Orleans, La., as distributors of Kaylo heat insulation for the area of Louisiana and Mississippi.

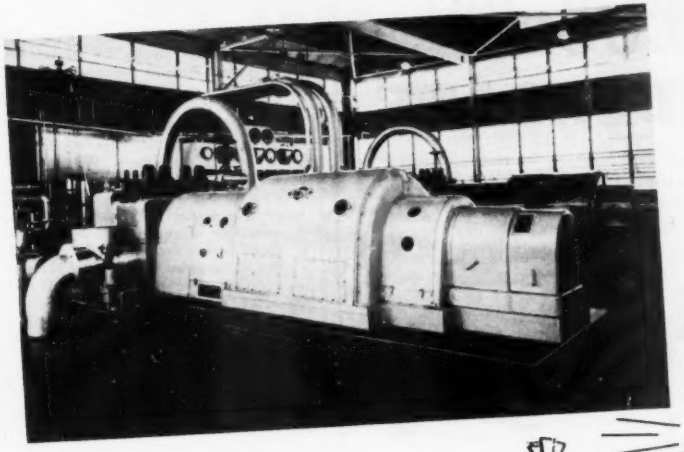
Albert E Binger Jr is promoted to industrial sales manager of **Philip Carey Mfg Co,** Lockland, Ohio.

Raybestos-Manhattan Inc, Manhattan Rubber Div, Passaic, N. J., has made John T M Frey assistant manager of the New York branch and Lamar S Hilton sales manager of the abrasive wheel dept.

Wayne E Williams is now western district manager for **Tube Turns of Canada, Ltd.** His office is at 110 Clark Bldg, Edmonton, Alberta.

American District Steam Co, North Tonawanda, N. Y., appoints J Gordon Ridsdale to newly created office of manager of defense production. Ridsdale's

HANDLING TWO JOBS AT ONCE...



and saving money on both!

Two 1500 KW Worthington turbine-generators, installed in the Eunice, N. M. plant of the El Paso Natural Gas Company. These are non-condensing extraction turbines designed to operate on initial steam conditions of 575# — 575° FTT exhausting at 5#G back pressure.

Worthington Turbine-Generators Selected By Natural Gas Firm For Both Power and Product-Conditioning

Pumping natural gas from southeastern New Mexico and the Texas Panhandle to points in California and Arizona, the El Paso Natural Gas Company uses Worthington Turbine-Generators for double duty Besides furnishing electricity for the company's plant in Eunice, N. M., the turbines automatically extract steam at 125#G for heating Amine solution, which is mixed with the gas to remove impurities.

In every branch of industry, users are getting daily proof of the outstanding flexibility of Worthington Turbine-Generator Sets — not only as sources of more dependable, more economical electric power, but as cost-cutting suppliers of processing steam for many important allied purposes.

WORTHINGTON TAKES ALL THE RESPONSIBILITY

Worthington builds Turbine-Generator Sets in sizes up to 10,000 kw, and in all types. Each is designed to make steam do more work, and each is backed by Worthington's undivided responsibility for the complete unit's design, assembly and performance. For expert aid in selecting the *right* size and type for your own requirements . . . and further proof that *there's more worth in Worthington* . . call our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

STEAM TURBINES

T-0-3

A GREAT TEAM IN STEAM

Feed Water Heaters

Multi-Stage Turbines

Boiler Feed Pumps

Turbine-Generator Sets

Single-Stage Turbines

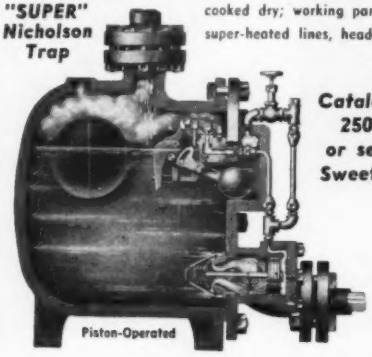
Surface Condensers

Most Widely Used Way of Trapping

HEAVY SLUGS of CONDENSATE

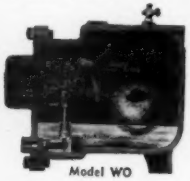
Thousands of installations on steam purifiers attest to the enormous drainage capacity of this Nicholson trap. Piston-operated and with valve orifices up to 2" diameter, it discharges large volumes of water almost instantly. Wont leak even if cooked dry; working parts of stainless steel. Also for super-heated lines, headers, separators, etc.

"SUPER" Nicholson Trap



Piston-Operated

Catalog 250 or see Sweet's

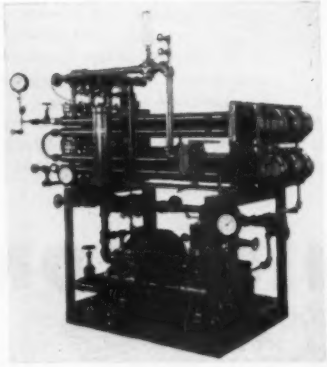


Model WO

NICHOLSON WEIGHT-OPERATED TRAPS — Three models for pressures to 200, 650 and 1500 lbs.; for steam, air, gasoline. Also feature large capacity and proof against leaking.

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.

LOCKETT FUEL OIL PUMPING AND HEATING SETS *Custom Built*



The efficient, compact unit illustrated consists of one Worthington Duplex Steam Pump and one Electric Motor-Driven Rotary Pump, and three banks of Griscom-Russell Twin G-Fin Fuel Oil Heaters mounted on a single structural steel frame.

FOR almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump is suitable for the full rated capacity of the unit; and one heater section is a spare. Lockett supplies everything, complete. *Inquiries are invited. Descriptive bulletins sent on request.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

duties will cover negotiating, contracting and liaison between the company and branches of the Armed Forces and various government agencies.

Edward F Doty, well-known designer of screw and rotary pumps, has become associated with **Warren Steam Pump Co,** Warren, Mass.

Worthington Pump & Machy Corp announces election of the following new officers of its subsidiary, Worthington-Gamon Meter Co: Charles E Wilson, chairman of the board of directors; Robert R Anderson, president; William C Flanders, vice-president in charge of sales; Walter H Zeis, secretary-treasurer. In addition, Louis G Hilkemeier is now chief engineer of construction equipment div of Worthington at Dunellen, N. J. Austin C Ross is elected vice-president of the company and will continue to serve as Buffalo works manager.

Corrosite Corp, has chosen **Graybar Electric Corp,** New York City, as national distributor for Corrosite, a new all-purpose, anti-acid, corrosion-resistant plastic paint.

T Bruce Carpenter joins **Youngstown Sheet & Tube Co** as superintendent of Brier Hill open-hearth dept. Carpenter succeeds H R Ryan who replaces Thomas A Cleary as superintendent of Campbell Works open-hearth dept. Cleary is now general superintendent of Campbell Works steel plant and Struthers Works.

S J Smith Co, 410 W River St, Davenport, Iowa, has been appointed by **Air Reduction Sales Co** as an authorized dealer of Airco products servicing Scott County in Iowa and Rock Island County in Illinois.

Ajax Flexible Coupling Co, Westfield, N. Y., announces election of Wayne Belden as executive vice-president and Charles Belden, vice-president. Robert G Cady is made sales manager.

R H McPeake becomes sales manager of **Aldrich Pump Co,** Allentown, Pa.

Baldwin-Hill Co has created a public utilities division of industrial sales, headed by P A Bell, with offices in the Reynolds Bldg, Jackson, Mich. M M Wilson continues as general manager of industrial sales, with E R Stevens, vice-president in charge of sales.

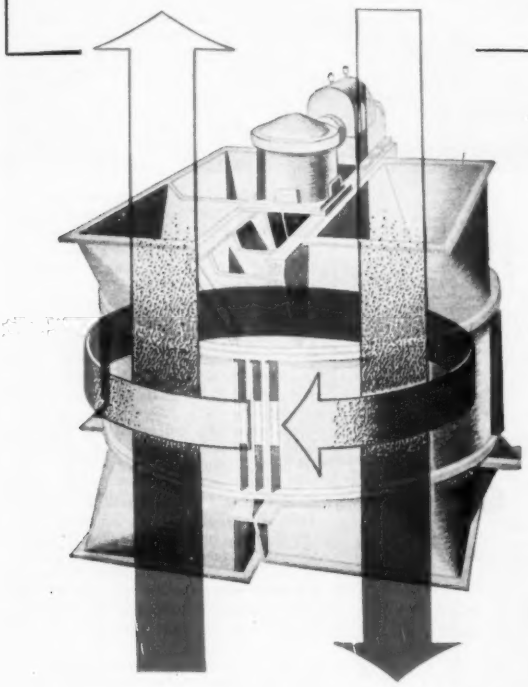
Edmund Fitzgerald, president of Northwestern Mutual Life Insurance Co, has been elected a director of **Chain Belt Co,** Milwaukee, to fill the vacancy created by the death of Walter Kasten.

Capewell Mfg Co, Hartford, Conn., announces acquisition of the facilities of **Armstrong Mfg Co,** Bridgeport, Conn. Production and distribution of the Armstrong-Bridgeport line will continue without interruption.

O P Robinson succeeds T S Towle, retired, as manager of **Cutler-Hammer's** Pittsburgh district sales office. Robinson will

Increase the efficiency of your present boiler

with the *Ljungstrom* AIR PREHEATER



The installation of a Ljungstrom air preheater on your present boiler offers the opportunity for considerable fuel savings that will more than offset the initial cost of the preheater in a matter of a few years.

The regenerative counterflow principle of the Ljungstrom permits operation at lower exit gas temperatures . . . assuring increased heat recovery and reducing the amount of fuel required. Moreover, the compactness and lightness of the preheater makes it possible to install it on your present boiler with minimum change in the existing structure.

For more information as to how you can approach modern performance standards with a boiler that is operating without an air preheater, or with out-of-date air preheater, write to the Air Preheater Corporation. Our engineers will welcome the opportunity to show you how the Ljungstrom can raise the over-all efficiency of your plant.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 EAST 42nd ST. • NEW YORK 17, NEW YORK

Stockpile Coal
the Safe, Easy
SAUERMAN WAY!

One-Man System Provides Economical Storage
Free From Hazard of Spontaneous Combustion

The operating personnel of power plants, mines, coal docks, etc., where Sauerman Power Drag Scrapers store and reclaim coal, are unanimous in their liking for this equipment. It is so simple—so dependable—and the pile it builds does not develop "hot spots."

A Sauerman scraper stacks coal layer upon layer, forming a pile that is homogeneous and safe from spontaneous combustion. The operator is housed in a comfortable control cab where he has a view of the entire storage area. The operation is automatic except that a few minutes of manual labor is required to change the operation from storing to reclaiming, or vice versa.

The machine operates 24 hours a day if necessary, with minimum upkeep. In the wide range of sizes and types of installations developed by Sauerman engineers will be found a satisfactory machine for almost any coal storage project from the smallest to the largest.

Handbook "Coal Storage by Scraper" free on request

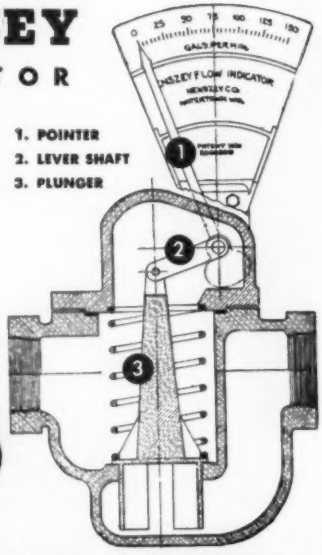
SAUERMAN BROS., Inc.
562 S. CLINTON STREET, CHICAGO 7, ILL.

Only 3 **MOVING PARTS**
in the **HENSZEY**
FLOW INDICATOR

There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct — without constants. The entire instrument can be installed right in the pipe line.

1. POINTER
2. LEVER SHAFT
3. PLUNGER



For details consult Sweet's Catalog or write:

HENSZEY COMPANY
Dept. D-1, WATERTOWN, WISCONSIN

HENSZEY
FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS

also supervise the Youngstown office in the sale of Cutler-Hammer motor control and allied electrical apparatus.

Dampney Co of America selects Allied Services Inc, Spring & Bullitt Sts, Charleston, as sales and service representative for southern West Virginia.

J Sharp Queener has been named to succeed Harold L Miner, retired, as manager of **Du Pont Co's** safety and fire protection division.

Electric Products Co selects Power Equip Co, Kansas City, Mo., as its representative in western counties of Iowa and Missouri, the Panhandle counties of Texas and the states of Arkansas, Oklahoma and Kansas.

Mervin A Fay has been promoted to assistant general sales manager of **General Refractories Co,** Philadelphia, Pa.

Gardner-Denver Co is establishing a Canadian plant. The new plant will be located at Brantford, Ontario, and will be operated by Gardner-Denver Co (Canada) Ltd. Key production men will be temporarily transferred from the parent plant, Quincy, Ill., to provide necessary initial supervision, but both skilled and unskilled labor will be obtained in Canada.

E C Barlow has become affiliated with **Charles J Haas Inc,** Philadelphia. He was formerly assistant to the executive vice-president of E F Houghton & Co.

Morse Chain Co, Detroit, announces reelection of F M Hawley as president and general manager and the appointment of new officers of follows: J N Candler, vice-president and assistant general manager; R J Howison, vice-president in charge of sales; E W Deck, vice-president in charge of manufacturing—Ithaca; M V Durkin, vice-president in charge of manufacturing—Detroit; W M Reynolds, secretary and treasurer; E G Wuensch, assistant treasurer; and V P Burgess, assistant secretary.

Executive, fiscal, and operations offices of **Laclede-Christy Co** have been moved to 310 S Michigan Ave, Chicago 4, Ill.

H K Porter Co has formed the Jarecki Valve Div, Tulsa, Okla., to handle the manufacture and sale of Jarecki valves formerly produced at Jarecki Mfg Co plant in Erie, Pa. Also, Lawrence L Garber has been made general manager of the American-Fort Pitt Spring Div, McKees Rocks, Pa.

Ralph S Lorimer is branch manager of **National Supply Co's** new office in Washington, D. C.

Purchase of **R-S Products Corp,** Philadelphia, by S Morgan Smith Co, York, Pa., has been reported. Present management of R-S Products Corp, W E Borbonus, president, and D W Hopkins, executive vice-president, will be retained along with the present board of directors. S Morgan Smith Co will provide two additional members of the R-S board, Burwell B Smith, vice-

Why the sea is salty

IN Norse mythology, a poor man got a magic mill from the elves. With it he could grind whatever he wanted--food, clothing, furniture, and best of all, gold. Of course, the poor peasant's lot changed from poverty to riches.

An envious brother borrowed the mill. He commanded it to "grind herrings and broth and grind them good and fast." But having taken the mill in such haste, he didn't know the magic words to shut it off. He was almost drowned in broth when the brother came to the rescue.

Finally, the magic mill was stolen by a salt dealer, who put it on his ship. Safely at sea, the skipper demanded, "Grind salt and grind it good and fast." Alas, he hadn't learned the control words either. The mill ground salt endlessly, filling all his kegs and his hold, covering the decks and at last sinking the ship. There at the bottom of the sea, so people say, the magic mill still grinds--and that's why the sea is salty.

From time immemorial, men have dreamed about magic mills and schemes to bring abundance and riches. Here in America, today, there are plans that are flooding us with superabundance of certain commodities. But what about the magic words to shut off the mill?

Isn't it time we see the truth in this ancient Norse myth, that "too much" is just as foolish as "too little?" We may well remember this first law of economics: In a *free* market, supply can adjust itself to demand--whether it be potatoes or steel--without sinking the ship. Here is a must job for all thinking Americans.

QUALITY V YOUNGSTOWN SERVICE

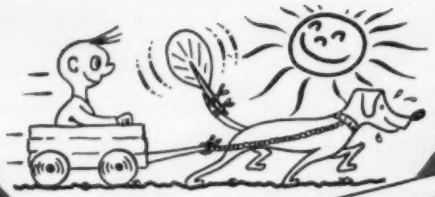
The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.



What Other Drive Gives You...

1. BY-PRODUCT POWER

Power to drive pumps, blowers or stokers...auxiliary electrical supply for special needs...off-peak or standby generating capacity—these can be obtained almost free by utilizing the By-Product Power available through Troy Steam Engines.

Steam used for heating or processing packs plenty of horse power as well as B.T.U.s. Under the right conditions, Troy Steam Engines can extract this latent power while actually improving the heat balance. By-Product Power can be converted into A.C. or D.C. electricity by efficient Troy Generating Sets, or it can be utilized directly to drive stokers, fans, pumps, blowers, kilns, compressors, mixers and similar equipment. With the Type EN Governor, constant speed can be maintained accurately; or speed can be automatically varied over an exceptionally wide range.

Double duty: Steam drives high pressure pumps and provides heat for processing in this installation of multiple Troy Steam Engines in the Port Arthur refinery of The Texas Company.

Plus—

2 HIGH STARTING TORQUE

3 UTMOST FLEXIBILITY

4 SIMPLICITY, LONG LIFE

5 ACCURATE, FAST SPEED CONTROL

Which Do *You* Need?

If your drive needs any or all of these five characteristics, the modern Troy Steam Engine is indicated. Send us your drive requirements and steam conditions, and our engineers will be glad to recommend the right type and size Troy engine to meet your needs.

Send for Bulletin 306

TROY

Troy Engine & Machine Co.

Power Equipment Division

2506 RAILROAD AVENUE • TROY, PENNSYLVANIA

president, and Duncan D McArthur, secretary, respectively, of the parent company. There will be no change in the operation of the Philadelphia concern.

Harry L Emerson is named vice-president in charge of manufacturing of the **Rockford Clutch Div,** Borg-Warner Corp, Rockford, Ill. He will continue as works manager.

Richardson-Allen Corp has moved to its new office and factory at 116-15 Fifteenth Ave, College Point, L. I., N. Y.

William A Marsteller has resigned as vice-president of Rockwell Mfg Co, and as vice-president and director of Edward Valves Inc, to establish the **Marsteller Co,** consultants in marketing and advertising. The new firm is located at 612 N Michigan Ave, Chicago.

Twin Disc Clutch Co, Racine, Wis., promotes Paul W Wahler to service manager and Robert A Harmon to dealer sales supervisor. Both men will make their headquarters in Racine.

Robert A Miller is now sales manager, gear coupling div, **Sier-Bath Gear & Pump Co,** North Bergen, N. J.

George W Ingham has been named assistant to works manager of **U. S. Air Conditioning Corp's** Minneapolis plant.

Thomas R Hughes becomes vice-president and sales manager of **Utica Drop Forge & Tool Corp.**

Harold L Rush is made district sales manager in the Richmond, Va., territory for **National Electric Products Corp.** Rush will make his headquarters at 100 W Main St, Richmond, and will report to W J Barnes, southeastern regional manager in Atlanta.

Weston Electrical Instrument Corp appoints William J Healey manager of the company's New York district office.

U. S. Rubber Co announces personnel changes as follows: Elmer H White, vice-president, is elected a director and member of the executive committee of the company. Frederick N Taff becomes plant engineer of the chemical plant at Naugatuck, Conn. Edwin D Meade replaces Joseph A Conlon as district sales manager, Chicago branch. Conlon is now manager of allied sales for the mechanical goods div, with headquarters at the firm's offices in Rockefeller Center, New York City.

Thomas M Fallon, formerly advertising manager of the machinery divsion of Dravo Corp, Pittsburgh, assumes duties of publisher's representative of the **American Society of Mechanical Engineers.** Fallon will represent the society's two publications, Mechanical Engineering and ASME Mechanical Catalog, in western Pennsylvania, Ohio and West Virginia. His offices are located in the May Bldg, Pittsburgh.

National Electrical Mfrs Assn elects new officers as follows: *President*—C W Higbee,

Call in this Remarkable Instrument

TO INCREASE POWER OUTPUT AT NO INCREASE IN COST

THE Cities Service Industrial Heat Prover is a flue gas analyzer which quickly, accurately and completely determines the heat generating efficiency of equipment using any type of fuel. With this information necessary adjustments to increase efficiency can be made.

A complete new line of petroleum products for the power field including:

- **D-C Diesel Engine Oils**
- **Pacemaker, Turbine and Compressor Oils**
- **Optimus Cylinder Oils**
- **Sentry Plant Machinery Oils**

The Heat Prover gives you the answers to these questions important to efficient production:

1. **How much energy is wasted in uselessly heating excess air?**
2. **How much excess oxygen is present in furnace gases?**
3. **What percentage of fuel is converted into useful heat?**

For a complete description of Cities Service Industrial Heat Prover Service, mail the coupon below for your copy of "Combustion Control for Industry."

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CITIES SERVICE OIL CO.
Sixty Wall Tower, Room 786
New York 5, N. Y.
Please send me without obligation your new booklet entitled "Combustion Control for Industry."

*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

ANY WAY YOU LOOK AT IT...

you can really read a **WESTON**

ALL-METAL THERMOMETER

Up in the air, down in a pit, across the shop . . . you can really read the big, open dial of a Weston Thermometer. And because these rugged, all-metal instruments stand exposure, abuse—you know the temperature you read is *right.*

Despite the angle of tank side or pipe, there's a Weston Thermometer to fit it. You can get models with stems that are long or short, that project straight from the back or out the side at any 15° position around the periphery of the thermometer head—whatever you need for *your* application.

Various industrial, *Max-Min, and contact-making types are standard. Consult your Weston representative, or write Weston Electrical Instrument Corporation, 626 Frelinghuysen Avenue, Newark 5, New Jersey . . . makers of Weston and Tagliabue instruments.

*Registered trademark.

WESTON *Instruments*

manager, electrical wire and cable dept, U. S. Rubber Co; *vice-presidents*—Arthur A Berard, president, Ward Leonard Elec Co; J H Jewell, vice-president, Westinghouse Elec Corp; J F Lincoln, president, Lincoln Elec Co; R E Murphy, vice-president in charge of sales, I-T-E Circuit Breaker Co; Alan F Sheldon, vice-president and general manager, Kennecott Wire & Cable Co; *treasurer*—L G Hall, President, Stackpole Carbon Co.

Howard Cooper has been elected president of **National Lubricating Grease Institute.** He is manager of technical service of Sinclair Refining Co, New York.

Robert Jefferson Carter succeeds A T Krook as Southwestern district manager for **Stone & Webster Engrg Corp** with offices in the Esperson Bldg, Houston, Texas. Krook is now president of Stone & Webster Canada Ltd.

Frank R Simpson becomes director of research and development for **Kuljian Corp,** Philadelphia engineers and constructors.

R B McElroy has joined **R W Beck & Associates,** public utility analysts and engineers. He had been employed by Washington Water Power Co for the past 30 years.

Melvin W Gelber, a licensed professional engineer in New York and New Jersey, opens offices at 222 Coolidge Ave, Hasbrouck Heights, N. J. He is a specialist in design of radiant heating and air-conditioning systems serving architects and heating contractors.

Coal traffic and development dept of **Chesapeake & Ohio Railway Co** announces that its North Carolina Fuel Service Engrg office is located at 205½ N Greene St, Greensboro, N. C. A S Morton, assistant fuel service engineer, in charge of this office, will take care of requests for fuel engineering service originating in that area.

OBITUARIES

Julius S Holl, 64, advertising manager of Link-Belt Co for almost 40 years, died Oct 24 at Presbyterian Hospital, Chicago, after a prolonged illness.

C Brooks Hudson, power plant engineer for Plymouth Cordage Co, Plymouth, Mass., died Oct 29.

Dudley G Bolton, 79, retired branch manager for Fairbanks, Morse & Co., at Dallas, Texas, died Nov 1 in a Dallas hospital.

Charles Henry Woolley, 44, assistant manager of proposition dept, Babcock & Wilcox Co, New York, died suddenly Nov 11 in Cranford N. J.

Louis H Egan, 69, former president of Union Electric of Missouri died Nov. 25 of pneumonia.

Refinadora Paulista, near Sao Paulo, Brazil will be the first sugar mill driven entirely from steam-turbines direct-connected to the rolls through reducing gears.

QUIMBY

. . . an old name with a new meaning

"Quimby," like "Warren," is an old name in the pump industry, going back as it does, to 1893 when the first balanced quadruplicate screw pump was built. The basic and exclusive design features which proved so successful have been retained, but progressive refinements have been made over the years, widening the scope of applications and markets.

Later, Quimby introduced their "Streamflow" Rotex Pumps designed with hydraulic and mechanical superiority, and incorporating the most modern improvements found in rotary pumps today.

Now, through Warren's acquisition of the Quimby Pump Division, you are assured of *Warren quality, dependability and service* in

WARREN QUIMBY PUMPS

WARREN-QUIMBY PUMPS

Original key men formerly with Quimby are being employed by us to engineer and supervise the manufacture and application of these pumps, which are now in production and shipments being made.

Your inquiries on Screw and Rotary types, as well as Warren's complete line of Centrifugal and Reciprocating Pumps are solicited.

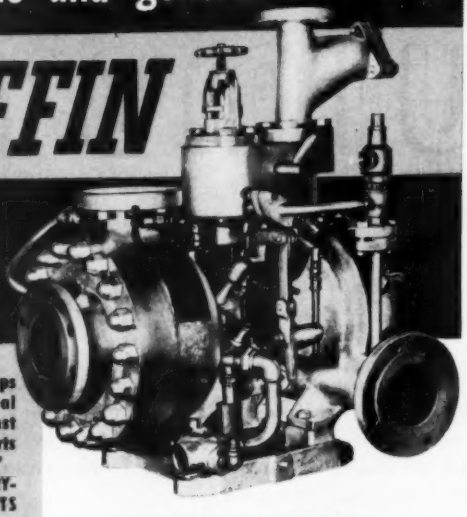
WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

G-1

Solve tough pumping problems in marine and general service

with **COFFIN**

TURBO PUMPS



Installing COFFIN Pumps Gives You These Vital Advantages plus Fast Service on Wearing Parts —ALSO "SAME DAY" SHIPMENTS OF FACTORY-GUARANTEED REBUILTS

- Steam Pressures to 850 PSI
- Back Pressures to 200 PSI
- Pump Capacities to 500 GPM
- Discharge Pressures to 1100 PSI
- Matched Pump, Turbine and Governors in One Lightweight Compact Assembly
- Efficient Pump and High Speed Two-Bucket Row Turbine Minimizes Steam Consumption
- Interstage Leakage is Eliminated
- All Parts Made to Gauge and are Replaceable Without Fitting

SPECIFIED FOR MINIMUM STEAM CONSUMPTION AND LONG, TROUBLE-FREE OPERATION—

Superior Coffin engineering provides 3 to 12 stage performance from compact 1-stage turbo pumps composed of standarized, easily replaced stock parts. The high efficiency Coffin Pumps combined with high speed, two-bucket row turbines conserve on steam at shaft speeds as high as 7200 RPM. Compact, with extremely quiet, vibrationless operation, Coffin Turbo Pumps reduce lost time due to pump failures by providing smooth, dependable performance over long periods of continuous service. For fast service on wearing parts or immediate shipment of a guaranteed rebuilt, call Coffin or your nearest Coffin representative.

THE J.S.COFFIN, Jr. COMPANY

324 SOUTH DEAN STREET
ENGLEWOOD, NEW JERSEY

AVAILABLE NOW! Write for your copy—

Complete data on Turbo Pumps for every marine and industrial application. Ask for your copy of the new Coffin File Folder, today!

REPRESENTATIVES IN ALL PRINCIPAL CITIES

POWER NEWS

(*Continued from page 138*)

Lastly, the expansion problem of existing hydro facilities is visioned as best handled as a joint program. The idea is that any new equipment going in will be slated for those areas where it can serve most efficiently for all Western Europe. OEEC is trying to arrange for international financing of at least part of the investment for this program.

Most of the experts now studying the proposed drive feel it will be necessary to create some sort of international Electricity Authority to get the needed tight and constant international cooperation. The time table calls for such a body within six months.

Alco of Canada Builds Hydro Plant

Aluminum Co of Canada has awarded to the Fraser-Brace Engineering Co, Montreal, a contract for construction of a hydroelectric development in the Saguenay region of Quebec. This announcement was made by Leland B Fraser, President of Fraser, Brace & Co, New York, and a director of the associated Canadian firm.

The new project will substantially increase the aluminum output of Alcan, now the largest producer in the world. Work will start immediately and will be rushed to completion at the earliest possible date.

The new development is at the Chute du Diable (Devil's Fall) on the Peribonka River, 30 mi above where the river flows into Lake St. John. This lake is at the headwaters of the Saguenay River, 300 miles north of Montreal, in the central section of Quebec. A dam and powerhouse for 200,000 hp will be built. Project will require excavation of 450,000 cu yd of rock and pouring 275,000 cu yd of concrete.

The first 50,000-hp unit is scheduled to run May 1952, with the others following at the rate of one a month.

The Peribonka project will increase by 10% the water-power facilities of the Saguenay area, which already has an installed capacity of 2,100,000 hp. This is 18% of the total for the Dominion. The Saguenay region is thus a major contributor to the power facilities of Quebec, which now has 53% of the developed water-power capacity of Canada.

The Saguenay area also includes the largest single hydroelectric development in the Dominion, the 1,200,000-hp Shipshaw No. 2 powerhouse, which supplies the Arvida plant of the Aluminum Co of Canada, the world's largest aluminum-producing plant. In addition to Shipshaw No. 2, at least 18 other hydroelectric developments are spread throughout the region.

Idaho Power Adds Plant

A new $18,500,000 power plant will be constructed by Idaho Power Co on Snake

for TOUGH Conveying Jobs...

Wilmot CHROME-MANGANESE Chain

Made of an alloy steel containing 12-15% manganese and 2% chrome, Chrome-Manganese chain is specifically designed for use where abrasion is especially severe.

Tests show that, under abrasive conditions, Wilmot Chrome-Manganese chain outlasts 2 to 3 standard chains of carbon steel. Work-hardening increases its Brinell from 220 to 450.

Standard Wilmot cast Chrome-Manganese steel chain, as listed below, is furnished with pins of heat-treated drop-forged steel. Pins may be obtained in cast Chrome-Manganese; also the important wearing parts, sprockets, sprocket teeth, and traction wheels.

MADE FROM CHROME-MANGANESE STEEL

Size	App. Pitch	Average Ultimate Strength	Weight Per Ft.
458	4"	48,000	3.5
468	4"	80,000	6.25
678	6"	85,000	6.75
698	6"	140,000	13.0
998	9"	140,000	10.5
9118	9"	230,000	17.0
9148	9"	325,000	28.0

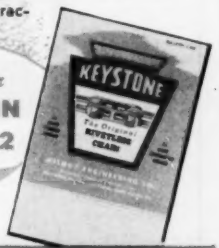
Everything for Your Conveyor

As the originators of Rivetless drop-forged steel chain, Wilmot

Wilmot Makes Largest Choice of Drop-Forged Chain & Attachments

stocks it in the largest choice of sizes available: 3" to 10½" pitches; average ultimate strengths to 460,000 lbs. Largest choice of chain attachments; cast iron or steel flights, sprockets, traction wheels, take-ups, shafting, bearings, casings, trough; for coal, sludge or ash conveyors.

Send for **BULLETIN C-502**



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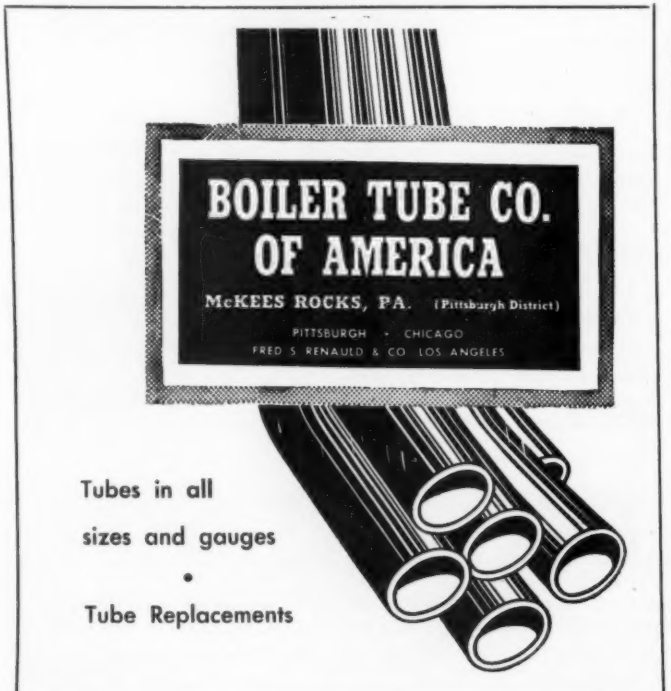


River about 7 miles upstream from Grandview in southwestern Idaho.

T E Roach, president and general manager of the company, said the plant, which will be capable of generating 90,000 kw, will be the largest of six plants constructed since 1946. It is scheduled for completion in 1952.

The new plant will bring the company's total generating capacity to almost 400,000 kw. Prior to its postwar construction, the firm's generating capacity was 105,000 kw.

Bureau of Reclamation Ups Hydro Capacity

Federal power output of Bureau of Reclamation projects hit a new high during the fiscal year ended last June 30, but more records are now being set. The Bureau's year-end totals show that Reclamation projects produced 19,796,568,376 kwhr during fiscal '50, compared with 18,356,098,684 kwhr in the previous year. Revenues jumped from $31,865,357 to $33,211,337.

Generating capacity was increased 411,000 kw during the fiscal year—a new record. Additions scheduled for the current fiscal year, which began July 1, are even greater, a total of 663,100 kw. Installed capacity was 3,218,400 kw on July 1, and it's expected to reach 3,881,500 by next July 1.

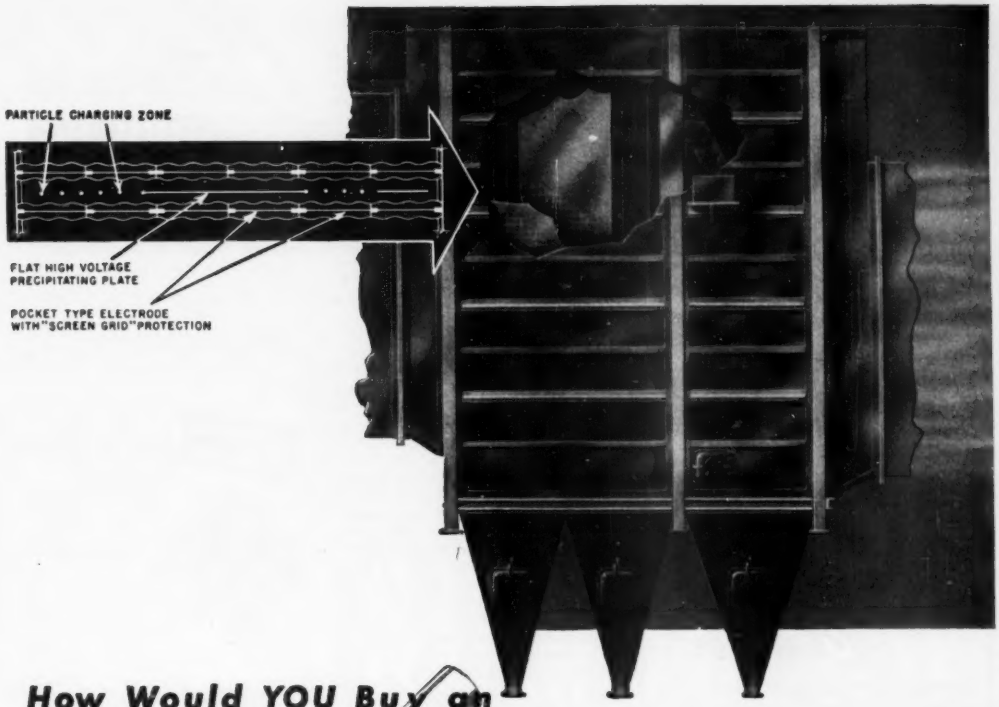
Biggest addition to Bureau capacity comes at Grand Coulee, which increased 324,000 kw during fiscal '50 and will be boosted 334,000 kw during the current fiscal year. Other capacity additions last year were 75,000 kw at Keswick in Central Valley and 12,000 kw at Kortes Dam on the North Platte River in Wyoming, first power from the Missouri Basin project.

POWER'S History

POWER was founded in 1884 by E P Harris and H M Swetland. With it was incorporated *Steam*, which had been started by N Hawkins in Chicago two years earlier.

In 1903 POWER purchased and absorbed *Science and Industry*, which was a consolidation of a number of periodicals, namely, *Home Study Magazine*, *Home Study for Machinists*, *Mechanic's Magazine*, *Home Study for Building Trades*, *Building Trade's Magazine*, *Home Study for Electrical Workers* and *Steam Electric Magazine*.

In 1908 POWER absorbed *The Engineer's Review*, of Cleveland, and *The Engineer*, of Chicago, the latter being a consolidation of *The Safety Valve*, *Lord's Power and Machinery Magazine*, *The Stationary Engineer*, *Steam Engineering* and *The Mechanical Engineer*. When *The Engineer* was purchased, the name of the combined magazine was *Power and the Engineer*. The title was condensed to POWER in 1911. All rights to the preceding titles reserved.



How Would YOU Buy an

ELECTRICAL PRECIPITATOR?

The basic elements of all electrical precipitator units are fundamental. All require a shell or casing with an inlet and outlet, the charging electrodes, precipitating or collecting electrodes, some form of rapping device, and a high voltage power supply.

The design of these elements, however . . . and their application to the process of electrical precipitation, is the governing factor between mediocrity and startling success.

It is highly important then, that the specifying engineer thoroughly investigate the refinements and latest developments on these basic elements and their overall effect on operating efficiency of the precipitator he is considering.

An investigation will indicate that the Aerotec Electrical Precipitator is far advanced in the four basic steps of precipitation:

1. Charging the particle.
2. Forcing charged particle to collecting electrodes.
3. Releasing the electrical charge.
4. Deposition in storage hopper.

Aerotec high voltage electrodes are subdivided for maximum effectiveness in charging and precipitating functions. Highest precipitating force is developed between flat plates, which provide a uniform field of high intensity.

To reduce the possibility of reentrainment of particles in the gas stream, Aerotec has developed a new "pocket type" collecting electrode. This unique design insures a dead zone surrounding the electrodes for maximum efficiency on both coarse and fine dusts. Release of carbon particles by induced charge, and loss of performance due to "backionization" are reduced to a minimum by this exclusive Aerotec design. Alternate rapping of the collecting electrodes reduces emission and minimizes stack "puffing" during rapping periods.

The Aerotec electrical precipitator is an ideal secondary for the Aerotec Mechanical Design 3 RAS, a combination that assures the highest efficiency possible in dust collection . . . an efficiency that will meet the most stringent dust requirements of today . . . and tomorrow.

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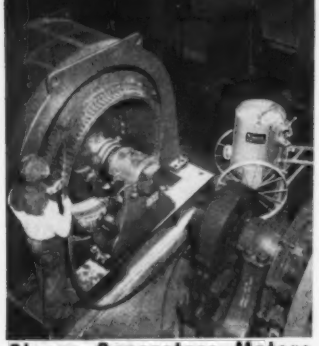
"CORN COB" Blast Machine



Cleans Generators, Motors

Faster Better Cheaper

Eliminates Toxic Hazard of Solvents!

THE new portable Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. in ⅓ the time of other methods. Material costs are reduced 90% and toxic or explosive solvents are eliminated.

Look at the savings shown by this recent test on electric motors. (Name of Company on request.)

Cleaning Duplicate 500 hp Synchronous Motors		
	Material	Labor
Solvent Method	$55.00	120 hrs.
PANGBORN Method	5.00	40 hrs.
SAVING	50.00 (90.9%)	80 hrs. (66.7%)

Remarks: With Solvent, drying period took an additional 8 hours.

SIMPLE OPERATION

New Pangborn AC-4 Blast Machines use standard 40-pound air supply to remove oil and greases with blast of soft, 20-mesh corncob grits. No residue left on parts . . . no drying period.

FOR FULL INFORMATION, write today outlining your operation. Address: PANGBORN CORPORATION, 90 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

Ontario Hydro Commissions To Start Niagara Work

Work will begin within a few weeks on a multimillion dollar power development at Niagara Falls to add 800,000 to 900,000 hp to existing capacity of the Hydro-Electric Power Commission of Ontario. This results from ratification by the U. S. Senate of a treaty for diversion of additional water from the Niagara River for power purposes.

Two new power plants (separated by about 100 ft) will eventually be built immediately south of the present Queenston-Chippewa plant, now called Sir Adam Beck —Niagara plant No. 1. The new plants, to be known as No. 2 and No. 3, will have a capacity of about 500,000 hp each.

First move is designed to step up the output of the present plant, No. 1, H.E.P.C., says Chairman Robert H Saunders. It is designed to handle 20,000 cfs of water but Hydro has been able to use only 15,000. As a result it is only generating 460,000 hp as against its over-all capacity of 580,000 hp.

A new tunnel and waterway will be cut through from above the Falls to the Queenston area, which will carry 20,000 cfs of water. It will be tied into the present plant and so add 120,000 hp from two units there. It is anticipated that these will be in operation by the summer of 1953. They could be ready sooner and will be if the power load continues to increase at the present rate, Saunders said. The No. 2 plant will also be started shortly and will take about three years to complete, he said. Plans for No. 3 plant will depend on load growth.

Norway Turbines Under 1287-Ft Head

McGRAW-HILL WORLD NEWS, *Oslo, Norway*: The two recently completed plants of the 90,000-kw Hol hydroelectric project in Norway have the highest head francis turbines in the world. Two in the Vätna station operate under 1287-ft head and the two in Urunda plant use 1155-ft head.

Pelton turbines have been used for such heads. Francis turbines operate at higher speeds and efficiencies than do pelton wheels. They use the entire head from forebay to tailwater levels, where pelton wheels must be set above the highest tailwater level. Lower runaway speeds and a saving in floor space are other advantages.

The four vertical Hol turbines are rated 62,500 hp at 500 rpm. The Vätna and Urunda plants are the first step in the Hol project, expected eventuall to supply 180,000 kw to the city of Oslo. A 220-kv line, 116 miles long, connects the plants with the city.

Following the death of President T H Bonfield of the **Iron Fireman Mfg Co,** a special meeting decided that the present officers would continue under the present titles until the next annual meeting. E C Sammons, a former director, was reelected to succeed the late president on the board. Frank S Hecox, general vice-president and treasurer, becomes chief executive of the company until the early February annual meeting.

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HOT FORGED from solid RECTANGULAR STEEL BARS to give you SURE-FIRE PIPING DEPENDABILITY

A TYPE FOR EVERY USE! **PERFECT SEAL even with pipe not in alignment!**

Standard & Double Extra Heavy **UNIONS**

Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

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With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

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With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

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With screwed or socket weld ends. 3000-lb. and 8000-lb. service.

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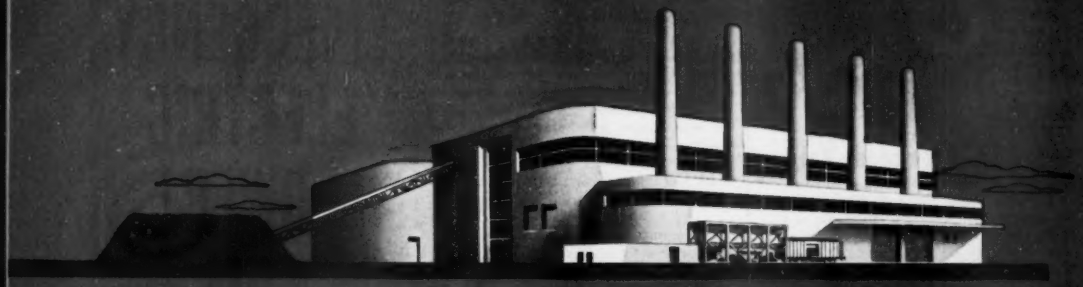

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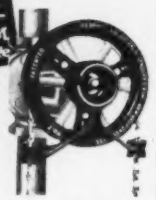
SPROCKET RIM
with Chain Guide



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• Pull the chain! That's all that's needed to open or close overhead valves—for complete control from the floor! Operating action of the BABBITT Adjustable Sprocket Rim with Chain Guide is as positive and immediate as that of direct manual control—and 100% safer because the risks of climbing treacherous stepladders, or on benches, machines or boilers is completely eliminated.

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• Range of 10 adjustable sizes takes care of all valve makes and types; fs valve wheel diameters from 2 to 30 inches. Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.

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High Pressure Steam
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SCOTTIE JR®

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6 sizes for 6 to 36 hp at 100 lbs wp . . . For coal, oil or gas . . . hand or mechanically fired.

Check the proportions of each Scottie Jr. and you'll see why it will actually produce approximately double the horse power guaranteed by its rating.

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for 6" scale with pipe diameter markings

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BOOKLETS

How to Determine the Size of Gears *(1950), by G E Katzenmeyer, consulting engineer. 24 pp, 9½x11 in., illust, 5 charts, 6 tables. Sent on request. National Erie Corp, Erie, Pa.*

Standard procedure for determining size and horsepower of gears of different materials. Calculations are worked through step by step, charts and tables are given for service factors; size of shaft; pitch diameter—pinion with bore; pitch diameter—pinion integral with shaft; pitch-line velocity; horsepower pinion of gear-face width and other factors. Data will be helpful to mechanics, draftsmen and engineers.

Recommended Practices for Salvaging Automotive Gray Castings by Welding, *by American Welding Society, 19 pp, 6x9, illust, paper, $0.50. American Welding Society, 33 W 39th St, New York 18, N.Y.*

Repair of gray iron castings by welding has now become an established means of economically reclaiming such castings. To meet the need for information on the best method to repair specific defects a study was made of repair methods in the automotive industry.

While these practices are based on this automotive study the information can certainly prove helpful as a guide in establishing repair methods for other castings. Information appears on oxyacetylene, shielded metal-arc welding, with and without preheat and stress relief, braze-welding, brazing, soft soldering, metalizing and use of mechanical methods.

Instrumentation Flow Plan Symbols, *RP5.1—1949. 14 pp, 8½x11, illust, paper. $1. Instrument Society of America, 921 Ridge Ave, Pittsburgh 12, Pa.*

This report on tentative recommended practices gives a system of symbols and identifications for industrial process instrumentation equipment. These symbols can be used for flow plans, specifications, listings, requisitions, piping and construction drawings, tagging of equipment and similar purposes.

Symbols and identifications presented are a result of an extensive survey of the best ideas and systems now in use. Although intended primarily for process industries the symbols are suitable for use in steam generation, fluid materials handling, air conditioning, etc.

Fundamentals of Steel-Casting Design. Steel Founders' Society of America, *32pp, 6x9, paper, 20¢. Steel Founders' Society of America, 920 Midland Bldg, Cleveland 15, Ohio.*

Major portion is devoted to detailed discussion and illustration of accepted rules of economical and dependable steel-casting design. Other sections deal with characteristics of the material, reasons why design engineers should concern themselves with steel-casting design and elimination of defects. An important part of booklet is concerned with improvements through conversion redesign with summary consideration of advantages obtained by conversion with respect to various competitive structures.

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EMERGENCY ELECTRIC POWER!

Model 10EL
10,000 watts

• Our special folder on Emergency Electric Plants contains helpful information on computing wattage requirements of standby systems, engineering and installation details. Complete specifications of Onan Emergency Electric Plants are included.

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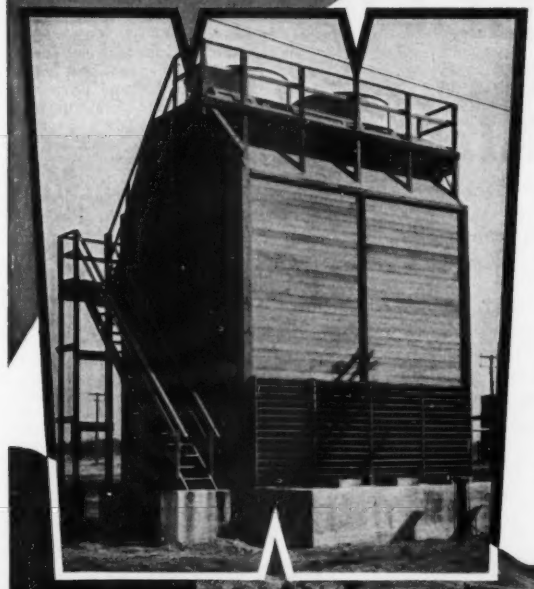
Save it with a C. H. W. Cooling Tower



Look how much this source of water has dried up! And this is no exception, either. More and more plants are feeling the "pinch" in water supply. Industrial expansion, plus higher domestic use, has overtaxed supply in many areas. Good surface water sources are low and, in areas where there is plenty, the quality is poor and costly to make usable. Although sufficient underground water deposits exist,* it will be several years before they can be tapped. All this means that you'll have to get the most out of what you have, or face production cuts or even a shutdown. But there is something you can do—use a C. H. W. cooling tower for operations requiring cooled water, thus permitting use of the same water over and over again. And you'll find that a C. H. W. cooling tower will not only save water and its cost, but also that cooling performance is guaranteed. For any operation requiring cooled water—chemical, processing, petroleum, air conditioning, etc.—check on a C. H. W. cooling tower first. Write for literature.

*According to Government surveys

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REPRESENTATIVES IN MOST PRINCIPAL CITIES

C. H. Wheeler
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DECK MACHINERY · STEAM CONDENSERS
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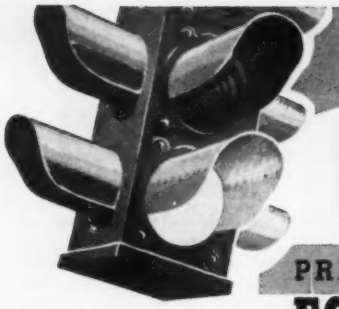
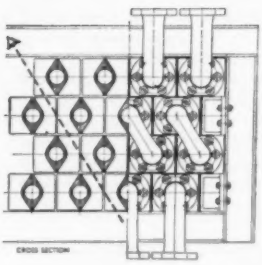


GREEN

PREMIER DIAMOND

ECONOMIZERS

The Economizer with the "Diamond" Design



Here are the four major values in the "diamond" shape of the Green Fuel Economizer:

1... Streamline flow of flue gases gives minimum draft loss

2... Finned tubes give maximum heating surface in given space

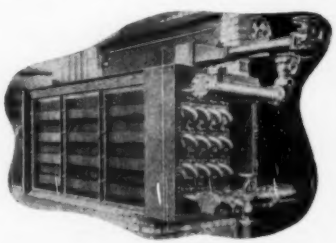
3... Staggered tube arrangement permits easy inspection

4... Minimum soot collecting surface is thoroughly cleaned by Green's "Special" Soot Blowers

Green Premier Diamond Economizers are available in either cast iron tube construction (Type 25) or steel tube construction (Type 12).

Pressure parts are rugged and joint flanges independent of support flanges.

Green Fuel Economizer's reputation of 60 years assures you of satisfactory performance and quality. Send for Bulletin No. 169.



THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

SAFETY CODE FOR INDUSTRIAL POWER TRUCKS. *(1950)* 31 *pp*, 5x7½ *in., illust, paper.* 85c *American Society of Mechanical Engineers, 29 W 39th St., New York* 18, *N.Y.*

Sponsored by ASME in accordance with the procedure of American Standards Association, this Code is designed as a guide for state and other governmental authorities in forming safety rules and regulations. It is intended also for manufacturers and for users of power trucks. The Code covers safety regulations relating to design, operation and maintenance of industrial power trucks of the driver-ride and driver-lead type, such as platform trucks, tractors, low- and high-lift trucks, fork and special industrial trucks, but not motor vehicles intended for use on highways.

SIMPLIFIED ELECTRICITY FOR UTILITY WORKERS—TEACHERS MANUAL, *by P. R. Rutledge.* 41-*pp booklet designed to accompany the full course of* 10 *units reviewed in August* 1951, POWER, *p.* 154, $1.50. *Published by Delmar Publishers Inc, Albany* 1, *N.Y.*

This manual fills the needs of utility engineers pressed into teaching service. It is also an aid to regular instructors. It outlines the objectives and materials required for presenting each lesson. A step-by-step outline gives the highlights the instructor should cover, and shows how they should be included, for each session.

Typical teaching visual aids are sketched in the appendix. A sample progress chart is also outlined.

Large Transformers Built for Ontario Hydro

Eight autotransformers have been built at the Davenport works of the Canadian General Electric Co, for the Hydro-Electric Power Commission of Ontario. These will be operated at the Kipling, Westminster and Burlington substations of the Hydro, receiving power at 230,000 v from the 500,000-hp Des Joachims station on the Ottawa River.

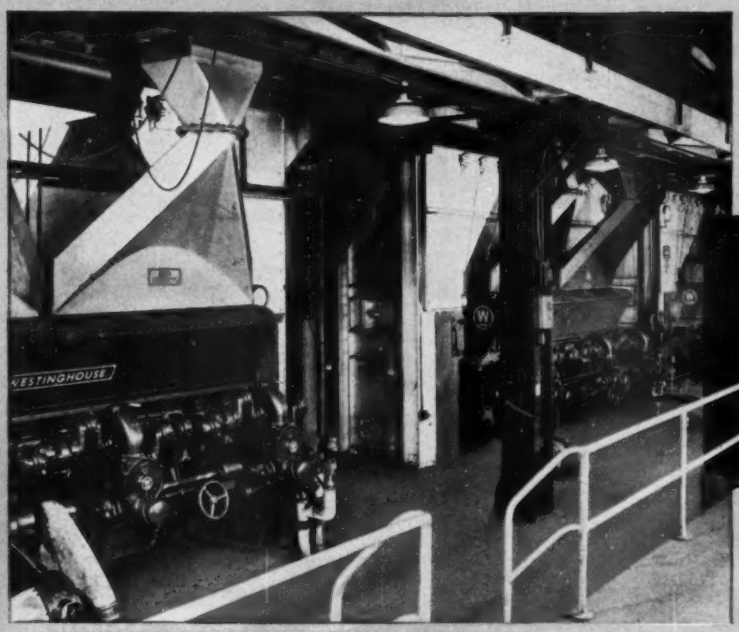
Each transformer is rated at 100,000 kva and is forcedair cooled, with five unit coolers installed on the tank to cool the oil. Heat is transferred from the coolers or radiators by blowing air from fans across the surface of the radiators. Fans are automatically operated by temperature detectors immersed in oil at top of transformers.

Contract for supplying a 26,500-hp hydraulic turbine for the Big Cliff powerhouse on the North Santiam River in western Oregon has been awarded by the Corps of Engineers to Baldwin Locomotive Works, Philadelphia, on a bid of $415,370. Big Cliff Dam, on which construction is scheduled to start in 1951, will be a re-regulating dam 2½ miles downstream from Detroit Dam. It is a part of the Detroit project.

Grand Coulee Dam boosted its capacity by 1108,000-kw in July and again in October. By April, 1951, an extra 108,000-kw unit is expected to go in.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



The chief engineer of the Bellefield Boiler Plant, Pittsburgh, Pa. checks instruments at panelboard in front of 3 Westinghouse Multiple-Retort Underfeed Stokers with Link-Grate. This modern, central heating station serves Carnegie Library and Museum, the Cathedral of Learning and the entire Pitt Campus, the Mellon Research Institute, the YMHA and four large hospitals.

14 YEARS' DEPENDABLE OPERATION...

MAINTENANCE COSTS only 1¾ cents per ton

Accurate records at the Bellefield Boiler Plant prove this outstanding economy story. Stoker maintenance costs for 14 years, totaled only $4,275 for 240,000 tons of coal consumed for an average cost of only 1¾ cents per ton of coal.

Maintenance economy like this is definitely a bonus beyond the exacting demands of continuous service . . . for RELIABILITY and CLEAN STACKS must be the prime consideration of plant management in serving a large group of public buildings. Only recently, another Westinghouse SDL Stoker was added to complete a battery of 3 Multiple-Retort Underfeed Stokers with Link-Grate that operate on a variable heating load of from 15,000 to 75,000 lbs. of steam per hour per boiler.

Westinghouse Stokers can give you these major operating advantages: Reliability, Flexibility, Lower Operating and Maintenance Costs. In addition you get the immediate attention of our Stoker Engineers for any of your heating, process, and power problems. Write today, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50519

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ENGINEERED INTO PIPING BY *NAVCO*

Careful and expert preliminary engineering work by Navco Engineers, in addition to employing the most modern fabricating and erection methods, are your guarantee of operating savings.

Consult Navco for just a Pipe Bend, or a complete Piping System.

- ★ Assured Safety
- ★ Efficient Operation
- ★ Minimum Fuel Costs
- ★ Low Maintenance
- ★ Long Trouble-Free Life

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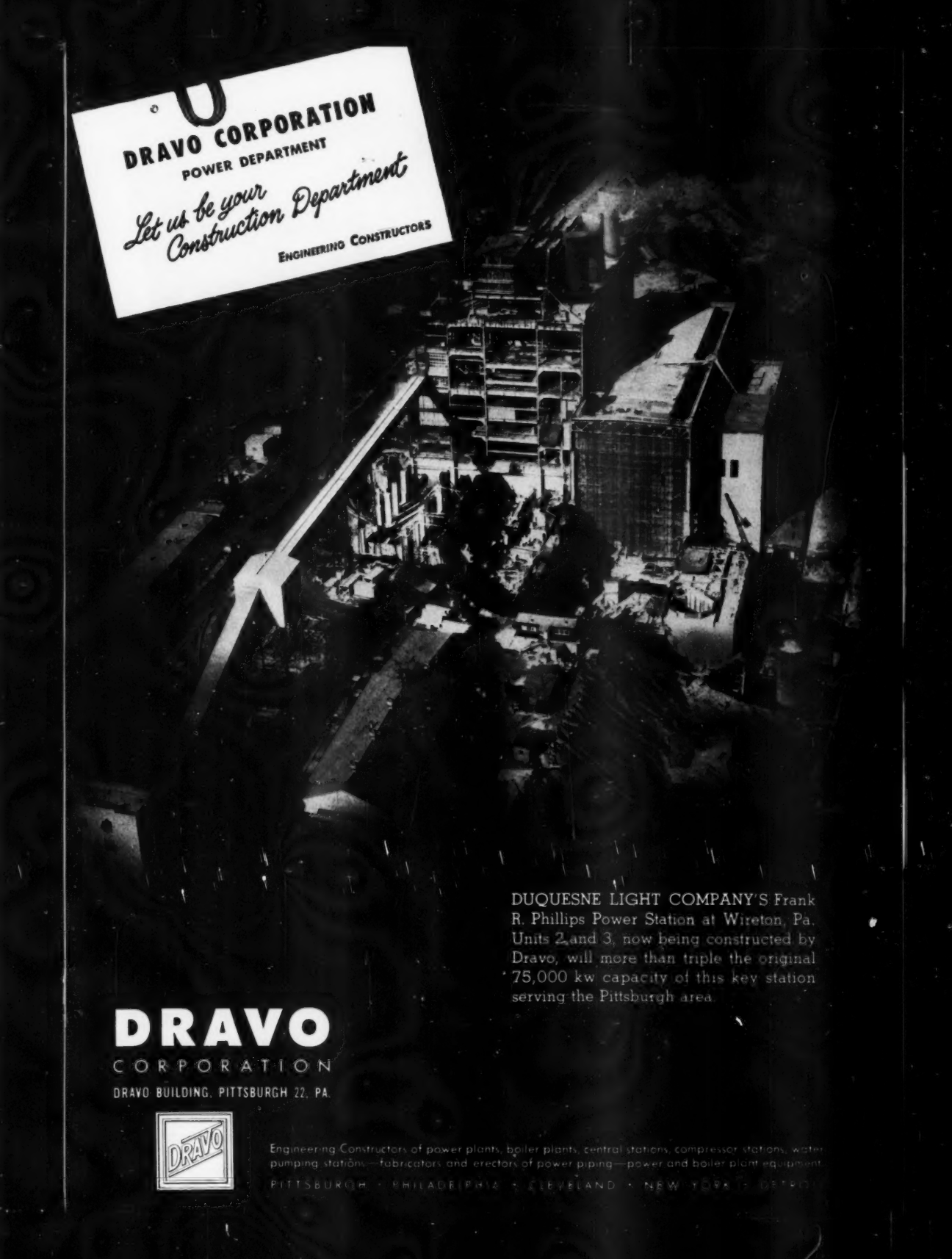

DUQUESNE LIGHT COMPANY'S Frank R. Phillips Power Station at Wireton, Pa. Units 2 and 3, now being constructed by Dravo, will more than triple the original 75,000 kw capacity of this key station serving the Pittsburgh area.

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CORPORATION

DRAVO BUILDING, PITTSBURGH 22, PA.

Engineering Constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations—fabricators and erectors of power piping—power and boiler plant equipment.

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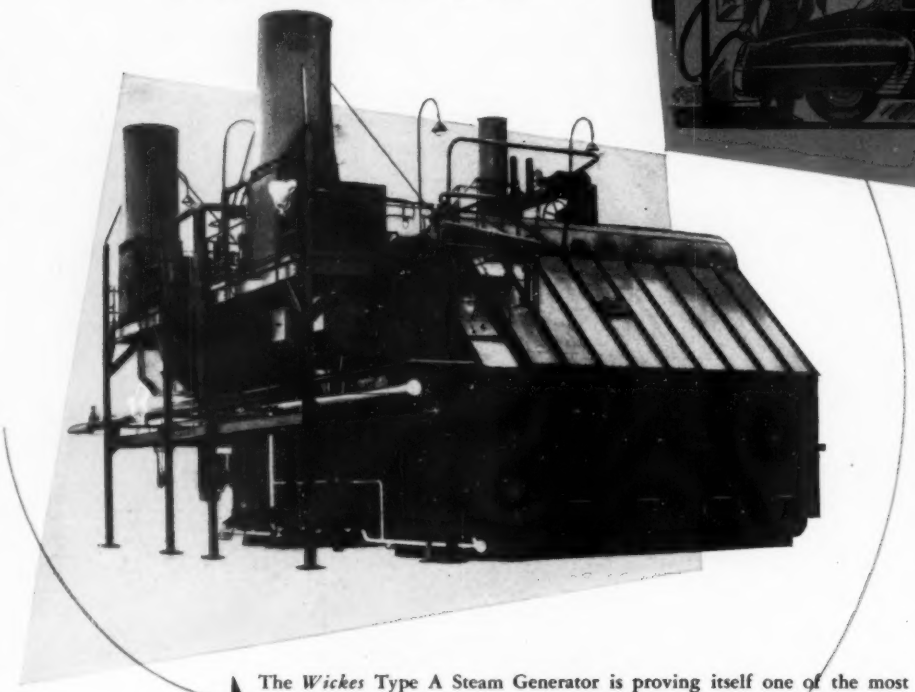
WICKES STEAM GENERATORS

at work in new Texas natural gasoline plant . . .



The *Wickes* Type A Steam Generator is proving itself one of the most serviceable boiler units employed by the oil and gas industry. These units, recently installed at a new Texas plant, each generate 80,000 pounds of steam per hour. The efficiency and ease of installation make the Type A boiler especially suited to the industry. *Wickes* can fill your exact requirements for boilers of any type up to 250,000 lbs. steam per hour and 850 p.s.i.

Wickes service facilities are world-wide and our knowledge of steam generation is available to you without obligation. Write for descriptive literature on the famous *Wickes* line of steam generators.

120

WICKES

THE WICKES BOILER CO. • SAGINAW, MICHIGAN

Division of The Wickes Corporation • Recognized Quality Since 1854

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PREVENT ENCRUSTATION OF VALUABLE EQUIPMENT

Unretouched photograph showing encrustation of turbine blade section.

USE DEARBORN POLYAMIDE ANTI-FOAM NO. 659

This section of turbine of a large generator was replaced because of blade fouling caused by improperly and inadequately treated steam boiler water.

Dearborn Polyamide Anti-Foam No. 659 would have substantially lengthened the life of this costly part . . . would have eliminated the time devoted to repair of the generator.

If you use steam in your plant, it will pay you to investigate Polyamide Anti-Foams . . . an exclusive Dearborn development that produces purer steam—eliminates scale formation in feed lines, heaters and economizers—prevents carry-over of suspended or dissolved solids—conditions sludge—is compatible with other treatment.

Consult Dearborn, whatever your needs in water treatment. Serving industry since 1887.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave. • Chicago 4, Ill.

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For information on Dearborn Polyamide Anti-Foams, write for Bulletin No. 5008. And for a complete description of Dearborn Industrial Water Treatment and Engineering Service, write for Bulletin No. 5000. The coupon is for your convenience.

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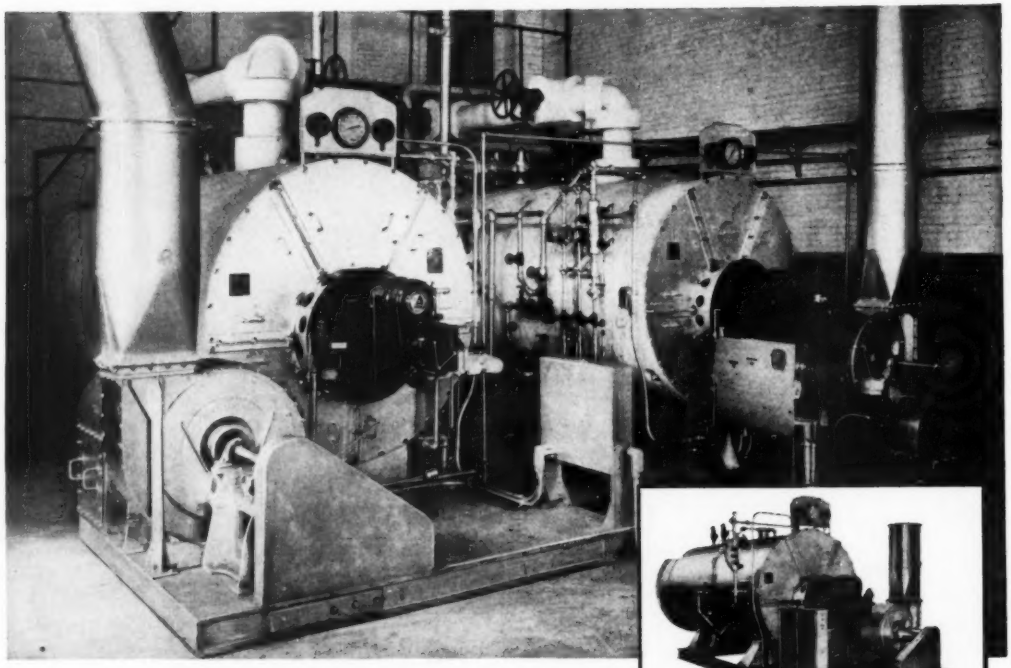
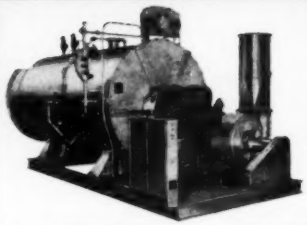
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

WATER TREATMENT AND SOFTENING COMPOUNDS • COMPLETE ENGINEERING SERVICE • NO-OX-ID RUST PREVENTIVES

Habitant Soup Co. Cuts Steam Costs 35%

with Preferred Units





Here's what the Habitant Soup Co. of Manchester, N. H., reports: *"More than two years ago we installed two Preferred Unit Steam Generators and we're frankly amazed at the small amount of fuel they consume to produce more than enough steam for our requirements. In fact, they cut our fuel bills by 35%.*

"Maintenance of the Preferred units is practically nil because they are fully automatic. We're glad to report that both boilers are working like a charm."

There are a host of good reasons for these savings. Fuel costs go down, for example, because Preferred Unit Steam Generators offer fully automatic operation with inexpensive No. 6 oil. But Preferred units assure *even more* than appreciable, immediate returns on your investment. They are designed to give *continuing economical* operation for at least 25 years.

For proof, read the 25-year features in the panel at right. For full details, send for Bulletin 1000.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

8 PREFERRED 25-YEAR FEATURES

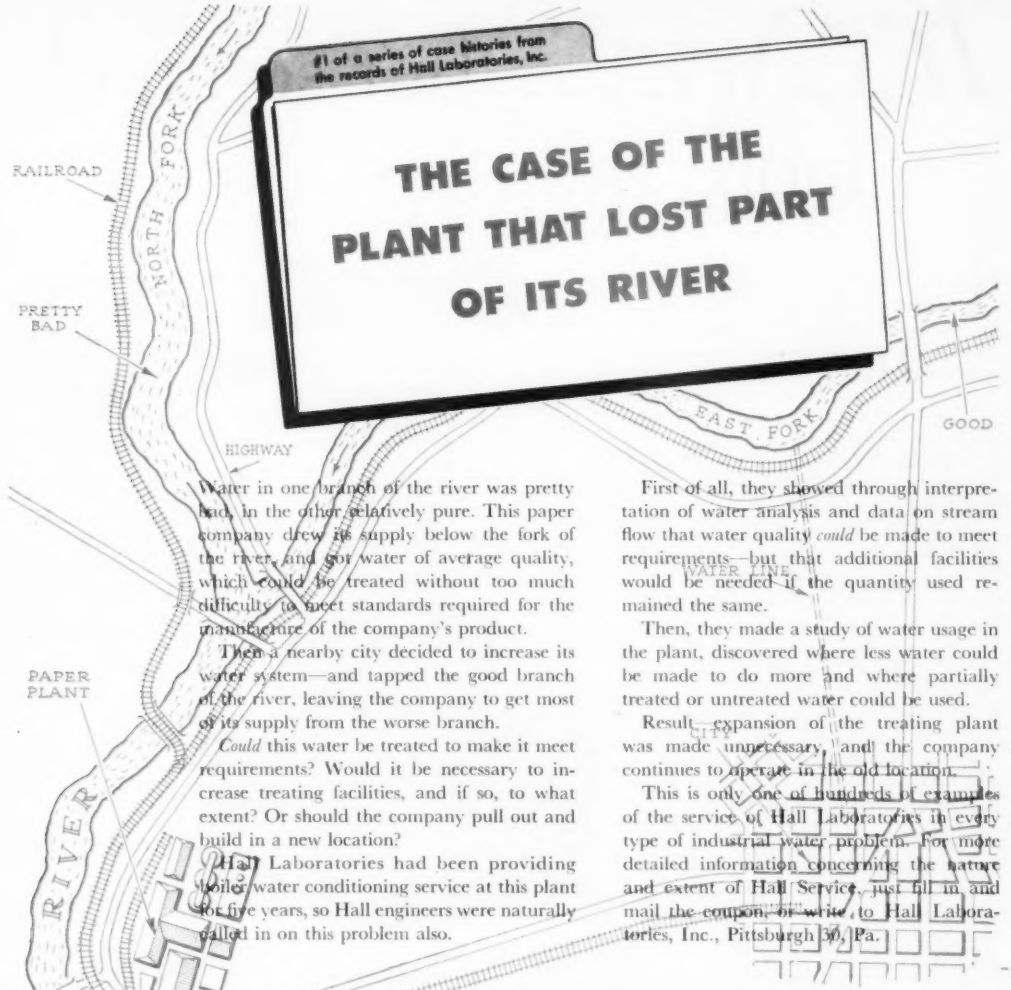
- **4-pass, high velocity, gas travel—minimizes tube cleaning maintenance by self-cleaning action.**
- **Staggered tube construction—minimizes the possibility of tube pitting, even at low firing rates.**
- **Preferred-built 4700 rpm Horizontal Rotary Oil Burner—assures fully automatic operation even with No. 6 oil.**
- **Anti-stress deck for tube sheet protection.**
- **Self-cleaning *induced draft* fan with air cooled shaft and bearings—built to last 30 years.**
- **Down-draft gas travel for 80% thermal efficiency—proved and guaranteed.**
- **Special *precipitator* developed by Preferred as aid to safe and clean operation.**
- **Dual purging cycles for positive elimination of gas stratification.**

PR-191

PREFERRED UTILITIES MFG. CORP.

#1 of a series of case histories from the records of Hall Laboratories, Inc.

THE CASE OF THE PLANT THAT LOST PART OF ITS RIVER



Water in one branch of the river was pretty bad, in the other relatively pure. This paper company drew its supply below the fork of the river, and got water of average quality, which could be treated without too much difficulty to meet standards required for the manufacture of the company's product.

Then a nearby city decided to increase its water system—and tapped the good branch of the river, leaving the company to get most of its supply from the worse branch.

Could this water be treated to make it meet requirements? Would it be necessary to increase treating facilities, and if so, to what extent? Or should the company pull out and build in a new location?

Hall Laboratories had been providing boiler water conditioning service at this plant for five years, so Hall engineers were naturally called in on this problem also.

First of all, they showed through interpretation of water analysis and data on stream flow that water quality *could* be made to meet requirements—but that additional facilities would be needed if the quantity used remained the same.

Then, they made a study of water usage in the plant, discovered where less water could be made to do more and where partially treated or untreated water could be used.

Result: expansion of the treating plant was made unnecessary, and the company continues to operate in the old location.

This is only one of hundreds of examples of the service of Hall Laboratories in every type of industrial water problem. For more detailed information concerning the nature and extent of Hall Service, just fill in and mail the coupon, or write to Hall Laboratories, Inc., Pittsburgh 30, Pa.

HALL LABORATORIES, INC.

(A SUBSIDIARY OF HAGAN CORPORATION)

CONSULTANTS ON BOILER WATER CONDITIONING;
PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER

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Please send me your bulletin:

☐ Your Most Important Raw Material ☐ Let's Consider Your *Whole* Water Problem

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It's New!... but so much more than just New

TO CONTROL and maintain processes at ideal flow, temperature, or pressure, the new 150# Hancock Bronze Flocontrol Valve is the most efficient and economical valve you can use.

Though it is a fine, strong, leak-defying valve, *it is also a precision control instrument.* The Hancock Flocontrol has a sturdy micrometer dial and pointer securely attached to the valve bonnet. This device enables the operator to "set" the valve at the ideal opening—within a 1/100th turn of the handwheel. And this precise setting can be exactly and instantly duplicated the next day, week, or month.

The scientifically designed V-Port disc *compels proportional flow throughout the entire lift of the valve stem.* Straight-line flow is not dependent upon the short-wearing, fine threads of a needle valve. The Hancock Flocontrol Valve has long-wearing standard Acme threads.

The shut-off seating surface is entirely separate from the controlling V-Ports. Wire drawing and cutting action are minimized; a separate shut-off valve is not needed.

Seats and discs are "500 Brinell" stainless steel. Foreign matter or steam cutting cannot affect their mirror-like finish.

Hancock Flocontrol Valves reduce production costs. They eliminate guesswork in the control of flow, temperature, or pressure.

"PIN POINT CONTROL"
Not just a "catch phrase" but an actuality. The Hancock Flocontrol Valve can be "set" to within a 1/100th turn of the handwheel for precise control of flow, temperature, or pressure.

OTHER HANCOCK FLOCONTROL VALVES FOR HIGHER TEMPERATURES AND PRESSURES

BRONZE FLOCONTROL, 300# W.S.P., 550° F.
Globe & Angle—Screwed Ends—Sizes ½" thru 2"
STEEL FLOCONTROL, 600# W.S.P., 850° F.
Globe & Angle—Screwed & Socket Weld Ends
Outside Screw & Yoke—Sizes ¼" thru 2"
STEEL FLOCONTROL, 600# W.S.P., 800° F.
Globe & Angle—Flanged Ends
Outside Screw & Yoke—Sizes ½" thru 2"

CAST STEEL FLOCONTROL—Screwed Bonnet—300# W.S.P., 800° F.
Outside Screw & Yoke—Screwed & Flanged Ends—Sizes 2½" & 3"
CAST STEEL FLOCONTROL—Bolted Bonnet—300# and 600# W.S.P., 800° F.
Outside Screw & Yoke—Flanged Ends—Sizes 2½" thru 4"

Contact your nearest Hancock Distributor for complete information

HANCOCK *Valves*

A PRODUCT OF
MANNING, MAXWELL & MOORE, INC.
WATERTOWN 72, MASSACHUSETTS

Makers of 'Hancock' Valves, 'Ashcroft' Gauges, 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties.

A new concept in Pneumatic Control:

The Taylor TRANSET* Control System

- **MORE ACCURATE MEASUREMENT**
- **CLOSER CONTROL ON ANY PROCESS**
- **CONTINUOUS SPACE-SAVING RECORDS**
- **HIGHER PROCESSING EFFICIENCY**

Taylor has developed a new controller and a new recorder to take full advantage of faster measuring devices, such as TRANSAIRE* Temperature and Pressure Transmitters and the Aneroid Manometers for Flow and Liquid Level. Each takes advantage of the other's superior performance. **Now available in a complete system.** The result—unprecedented quality of process control.

1. FASTER MEASURING INSTRUMENTS. Taylor's TRANSAIRE, force-balance temperature or pressure transmitters, created new standards in the measurement of *changing or dynamic* temperatures and pressures. With derivative action (SPEED-ACT*) in the measuring system, they transmit process changes with unbelievably fast accuracy. Many other features.

2. FASTER CONTROL with Stability! Taylor's new TRI-ACT* Controller combines a wider range of response adjustments, an increased capacity relay air valve, and a *new control circuit*, to take advantage of the faster measuring systems. This new force-balance controller permits 4 times faster reset rate and 4 times faster rate action (PRE-ACT*) than conventional controllers. No overpeaking. Faster recovery for load changes on pressure, flow, and temperature applications—because rate action is in *the new circuit*.

3. MIDGET RECORDER saves space. New TRANSET Recording Receiver greatly reduces panel space. Fits 3⅞" x 4½" panel opening, making it especially adaptable to graphic panels. Gives continuous 30-day process record, with 3 hours visible—remote setting of control point—automatic to manual control—instant check on controller performance and the control valve position.

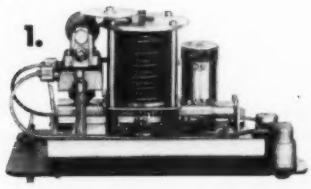
We sincerely believe this new Taylor-engineered TRANSET Pneumatic Control System combines *the best transmitter, the best controller, and the best recorder* on the market. Find out more about it, and put it to work for you! Write for **BULLETIN 98097,** and ask your Taylor Field Engineer. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

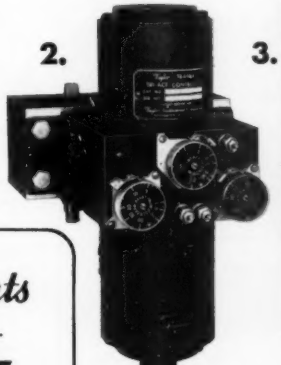
Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.

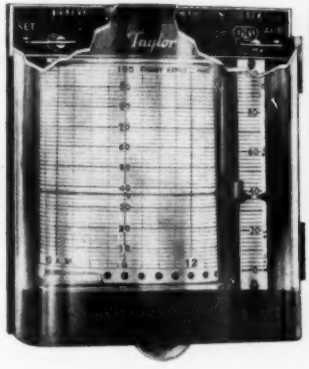
Taylor's Centennial ACCURACY FIRST SINCE 1851

TRANSAIRE ➔ TO TRI-ACT ➔ TO TRANSET

*Trade-Mark







Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

1. TRANSAIRE force-balance temperature or pressure transmitter with SPEED-ACT gives rate action in the measuring circuit. **2. TRI-ACT Controller.** Has high capacity relay air valve for faster response to new control circuit. Wider response adjustments. **3. TRANSET Recorder.** Fits 3⅞" x 4½" opening . . . a "natural" for graphic panels; a great space saver for conventional panels.

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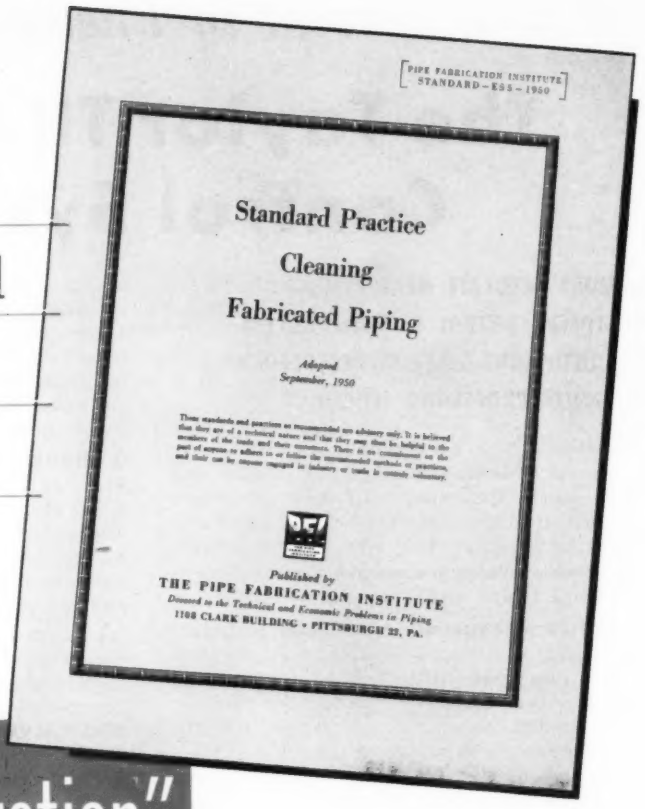
PFI Standard for Better Piping



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Assures Quality and Promotes Economy

This new Standard, prepared and published by the Pipe Fabrication Institute, is approved cleaning practice among qualified pipe fabricators. Its use assures you piping subassemblies that are clean . . . ready to erect.

This is the fifth Standard published by the PFI (see list in coupon at left) to suggest standardized design features and procedures for designers, fabricators, contractors and users of pressure piping. These Standards are often helpful in getting better piping and maximum value per dollar of cost . . . in saving time on the drawing board, in procurement of materials, during fabrication and erection of the job. Copies are freely available . . . just use the coupon.

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Please send me without cost, the PFI Standards checked below. Also place my name on your mailing list to receive additional PFI Standards as they become available.

- ☐ Machined Backing Rings and End Preparation for Welding
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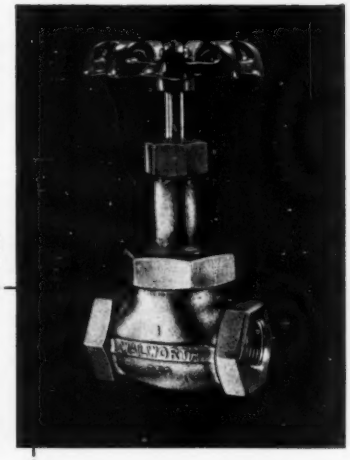
IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.



take a good look at the Walworth "500 Brinell" no. 225P Globe

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION, DEEP STUFFING BOX AND RUGGED STUFFING NUT: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.

EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,000 psi.

WALWORTH

valves and fittings

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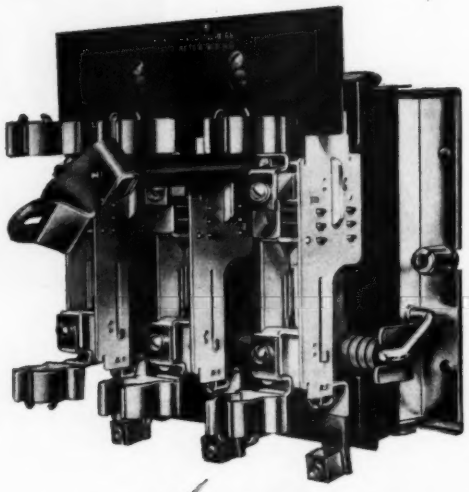
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

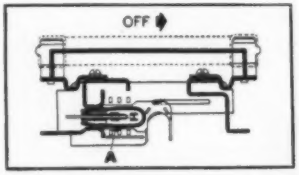
TRUMBULL'S HCI

HIGH CAPACITY INTERRUPTER

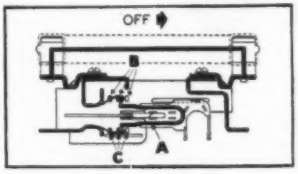


Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.

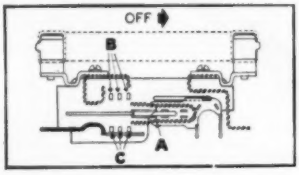
Here's How...
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Heavy line is current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

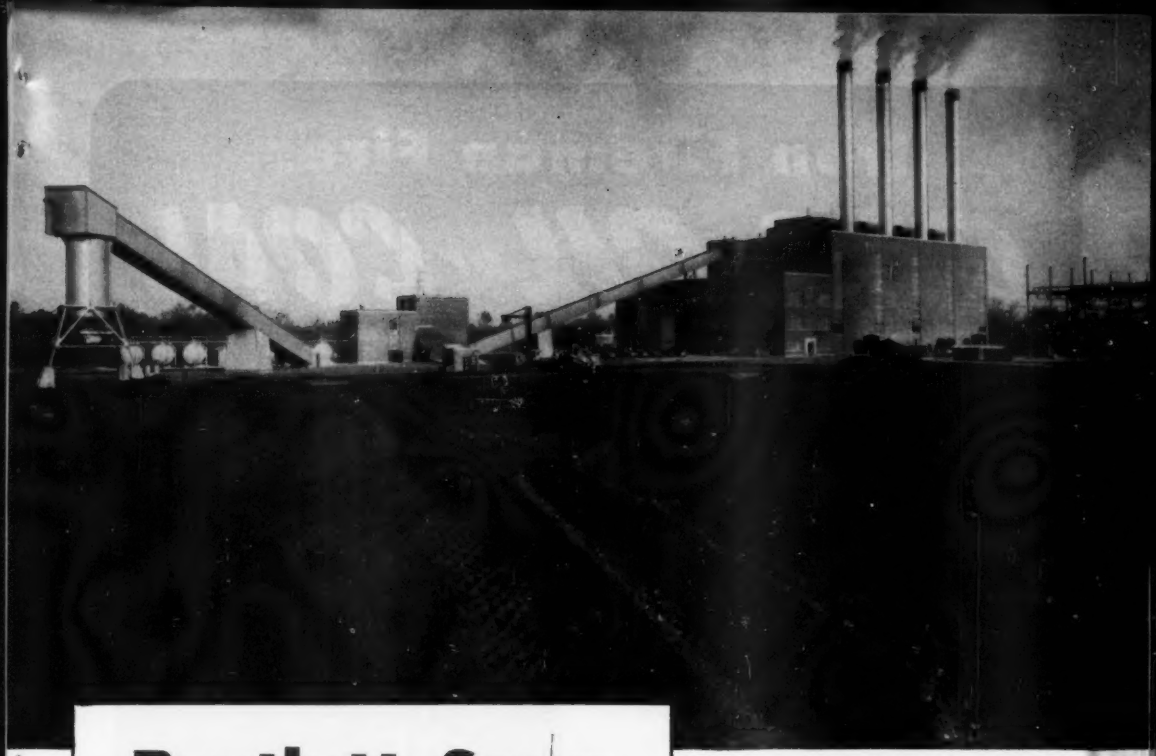
Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



General View of Meredosia Power Station
Central Illinois Public Service Co.
Sargent and Lundy
Consulting Engineers

Bartlett-Snow coal handling at Meredosia

● The illustration above shows the first 100,000 KW unit of a plant which is to be extended into a 200,000 KW station. All coal handling equipment including the receiving and reclaiming hoppers and grillage, duplex feeder, conveyors, galleries, breaker screen and all supporting structures were fabricated in our shops, and installed by us, to Sargent and Lundy's specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, with their long experience and complete facilities, work with you on your next job.

DESIGNERS
ENGINEERS
FABRICATORS
ERECTORS

BARTLETT-SNOW
CLEVELAND 5, OHIO

Belt Conveyor in Tunnel
Handling Coal from Track Hopper

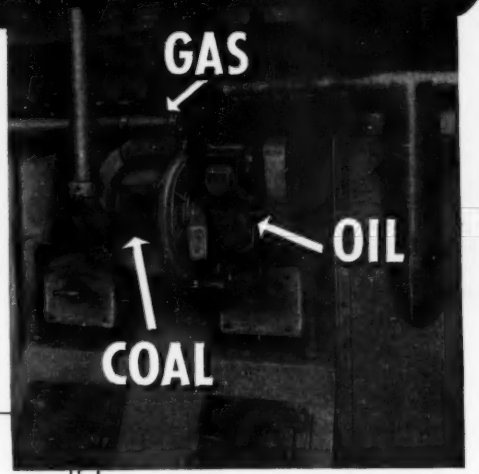
Drive for Collector Belt Under Breaker
the Refuse Belt and Automatic Sampler

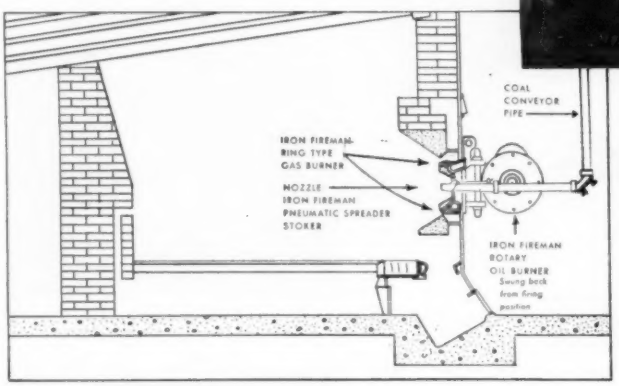
Iron Fireman Fires GAS, OIL or COAL in the same boiler

Switch fuels quickly

Guard your plant or buildings against possible fuel shortages. Protect yourself against high fuel costs. Equip your boilers to burn whichever fuel is lowest in cost or most readily available.

Iron Fireman builds and installs highly efficient automatic firing equipment for coal, oil or gas. It has also developed combination units for firing any two of these fuels—or all three—with quick changeover from one fuel to another.




COAL CONVEYOR PIPE
IRON FIREMAN RING TYPE GAS BURNER
NOZZLE IRON FIREMAN PNEUMATIC SPREADER STOKER
IRON FIREMAN ROTARY OIL BURNER
Swung back from firing position

Shown above is boiler front equipped for firing with coal, oil or gas. The Iron Fireman Pneumatic Spreader stoker delivers coal from hopper or from main coal bunker by pneumatic conveyor, and conveyor nozzle (shown here in firing position) accurately spreads the larger particles of coal over the entire grate in a shallow, uniform fuel bed. Preheated fines burn in suspension. For oil firing coal nozzle is withdrawn and Iron Fireman Rotary oil burner (for No. 6 oils or lighter) is swung into firing position. For gas firing the Iron Fireman Ring Type gas burner is used, in which stainless steel gas jets surround the firing port. In an emergency the fuel change can be accomplished in a few minutes.

Diagram at left shows three-fuel installation in straight tube boiler.

In many applications the Iron Fireman underfeed stoker can also be used in conjunction with the Iron Fireman gas-coal combination burner.

Iron Fireman engineers will gladly make a free survey of your boiler plant, and give you an estimate on firing equipment that will pay you new profits as well as insure you against losses due to changes in fuel prices and availability.

Write for illustrated folder to Iron Fireman Mfg. Co., 3238 West 106th St., Cleveland 11, Ohio. Plants in Cleveland; Portland, Oregon; Toronto, Canada. Sales, service and engineering organization covers the United States and Canada.

IRON FIREMAN

AUTOMATIC HEATING WITH GAS, OIL, COAL

STOP with KEY

LEAKS
CORROSION
GASKET AND PARTS REPLACEMENT
LOST EFFICIENCY

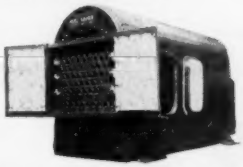
SAFETY HAND HOLE CAPS

In Water Tube Boilers

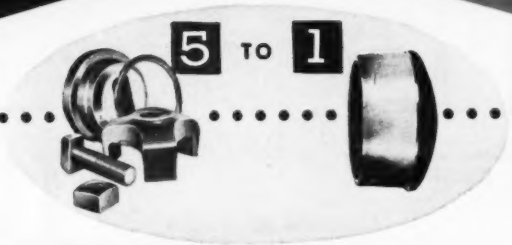
IN LARGE BOILERS

Key Safety Hand Hole Caps are tapered to fit tapered hole on headers of water-tube boilers. They provide safe, sure, metal-to-metal closure. The higher the pressure, the tighter the Key Cap.

IN SMALL BOILERS



One-piece Key Caps replace old style, clumsy five-piece affairs which are likely to cause leaks and are difficult to handle. Leaks cost money! The use of Key Caps also saves time in cleaning boilers.



THERE ARE NO PARTS TO WEAR OUT IN KEY CAPS. OVER 3,000,000 IN ACTIVE SERVICE.

Prove the economy and superiority of Key Caps in your own boiler at no cost. Write for free demonstration.

KEY TUBE HOLE CAPS for Your Economizers, Superheaters and for Blanking Off Tube Holes (Water or Fire)

THIS

KEY STRAIGHT WALL CAP

NOT THIS

OLD, COSTLY

Send today for complete catalog

KEY COMPANY
2819 McCausland Avenue
[illegible]

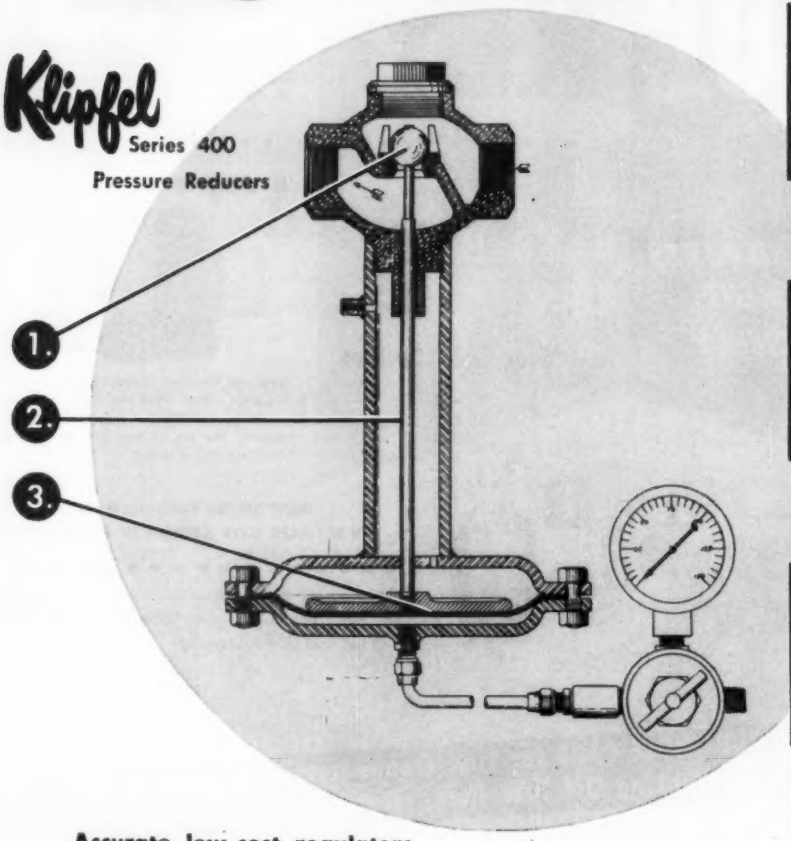
The KEY TUBE HOLE CAP does a perfect job wherever tube holes or hand holes must be absolutely right. They are

Efficient
Economical
Safe
Reliable

KEY TUBE HOLE CAPS inserted from outside or inside of header and rolled in place. There is no need to weld to get tight joints.

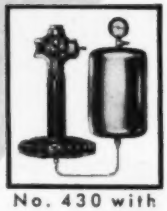
only 3 moving parts

Klipfel Series 400 Pressure Reducers



No. 432 with constant air supply—for quick, easy adjustment.

No. 431 with air dome—for isolated installations.



No. 430 with separate air tank—for variable ambient temperature.

Accurate low-cost regulators . . .

FOR longer service with negligible maintenance, operating parts are reduced to just three, inner valve, stem and diaphragm, in the Klipfel 400 Series air-loaded Pressure Reducing Valves. In addition, these 400 Series Valves provide exceptionally close regulation for an unusually low initial cost.

The stainless steel ball inner valve is a perfect sphere, extremely hard and well guided to close to a tight seat. Easily reseated if necessary . . . is self-cleansing and non-sticking. Diaphragm is always in balance . . . no stress, no bursting. Regulation is accurate and easily controlled. For increased safety, flow automatically shuts off in case of diaphragm failure.

For full data on the Klipfel 400 Series Valves, for steam, air, water or gas, write Dept. BC-1 for Bulletin No. 148.

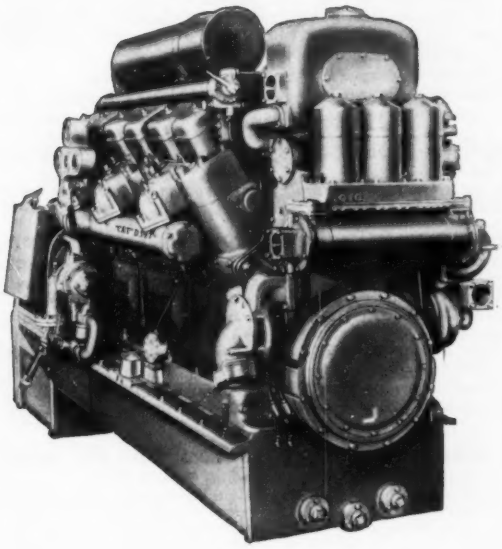
Klipfel VALVES INCORPORATED

DIVISION OF HAMILTON-THOMAS CORP., HAMILTON, OHIO

"Build-up never made a champion.
Real quality must be *built in,"*

says **CATERPILLAR**
REG. U. S. PAT. OFF.

therefore, extreme caution in selecting such vital components as heat exchangers



The reputation of "Caterpillar" Diesels comes from no one policy or practice, but from a number of things that are an integral part of every engine leaving the plant at Peoria, Illinois. "Caterpillar" sums it up in three words — *built in quality!*

To those having had no personal experience with "Caterpillar" Diesels, *quality* is probably too broad a term, but not so for "Caterpillar" users. To them, it's the combined result of meaningful research . . . sound design, engineering and construction . . . high standards in selecting materials and components.

Yes, standards for selecting such important components as heat exchangers *must* be high . . . because lube oil and jacket water cooling efficiency is so vital to the performance *and the reputation* of "Caterpillar" Diesels. Failure of an exchanger, or any other component, can well be a black mark against the whole engine.

And so it is, on the "Caterpillar" installations displayed here, and in countless other applications — oil drilling, mining, pipelines, sawmills, factories and farms, to name a few — you'll find the heat removal job entrusted to Ross Exchangers. For Ross has a quality reputation, too . . . the kind that "Caterpillar" and other leading Diesel builders require . . . the kind that matches their own.

*** DESIGN DATA IN ROSS LITERATURE** Whether the Diesels you build or buy have large or small H.P. ratings, Ross can furnish fully standardized units from stock. Complete literature mailed at your request.

ROSS HEATER & MFG. CO., INC. Division of American Radiator & Standard Sanitary Corp., 1415 West Ave., Buffalo 13, N. Y. Represented in Canada by Horton Steel Works, Limited, Fort Erie, Ontario.

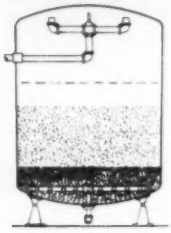
ROSS
Standardized EXCHANGERS

Five "Caterpillar" Diesel Electric Sets generating power for floating cutter dredge operating in large project in Lagos, Nigeria, West Africa. All have both Ross lube oil and jacket water coolers.

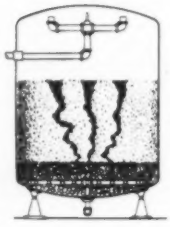
One of two "Caterpillar" Diesels driving all machinery in cotton gin plant of Duncan Co-operative, Invarness, Miss. Ross lube oil coolers on both.

"Caterpillar" Diesel Electric Set, equipped with Ross lube oil cooler. Mountain Utilities Corp.'s standby power plant for city of Aspen, Colorado. Also powers world's largest ski lift.

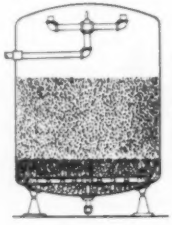
Is your water softener operating in the HIGH COST zone?



Check for zeolite loss



Check for packed and channelled zeolite



Check for worn out zeolite

Here's an easy way to find out

Far too many zeolite water softeners in use today are operating in the high cost zone—without it being known. How about your softener? Is it delivering less soft water than it did when new? Does it require more frequent regeneration with greater salt consumption? If so, it is operating in the high cost zone and you are not getting full value from your investment.

LOSS OF ZEOLITE can cause a big drop in soft water output.

PACKING AND CHANNELING will greatly reduce water softening capacity, cause hard water to leak through the softener and damage the zeolite.

WORN OUT OR DAMAGED ZEOLITE can also cause a big reduction in soft water gallonage.

Any of these troubles necessitate more frequent regeneration with greater salt consumption.

How to make your water softener perform like new

Any lost zeolite should be replaced with new at once. Damaged or worn out zeolite should be completely replaced. Packing and channeling can be remedied by loosening up the zeolite and providing the backwash rate required to properly cleanse and agitate the zeolite so that packing will not recur.

Your Elgin representative will be glad to check your softener and show you how to make it perform like new. With all types of zeolite to choose from, he can provide the kind you need. Whatever the type, you may be sure it will give maximum capacity and years of efficient service.

How to make it deliver up to 10 times more soft water

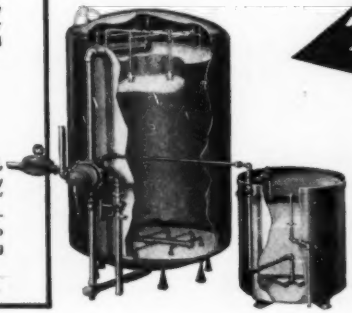
If your softener uses one of the older type zeolites of low softening capacity, you can switch to one of the amazing new Elgin high capacity types. In this way, it may be possible to get as much as 10 times more soft water from your softener. But even if the zeolite in your softener is entirely satisfactory, we can increase its capacity as much as 44% and prevent future costly zeolite loss. The ingenious Elgin Double Check type manifold, adaptable to any make of water softener, makes this possible. It permits the use of a deeper zeolite bed in your present softener which provides the added softening capacity as diagrammed below. Your Elgin representative can show you how this manifold arrangement can be installed at low cost in your water softener.

ELGIN SOFTENER CORPORATION, 130 N. Grove Avenue, Elgin, Illinois

WRITE US TODAY for full particulars

Shallow zeolite bed of ordinary water softener gives limited softening capacity.

Deep zeolite bed, made possible by Elgin "Double Check" Manifold arrangement, gives up to 44% more softening capacity.



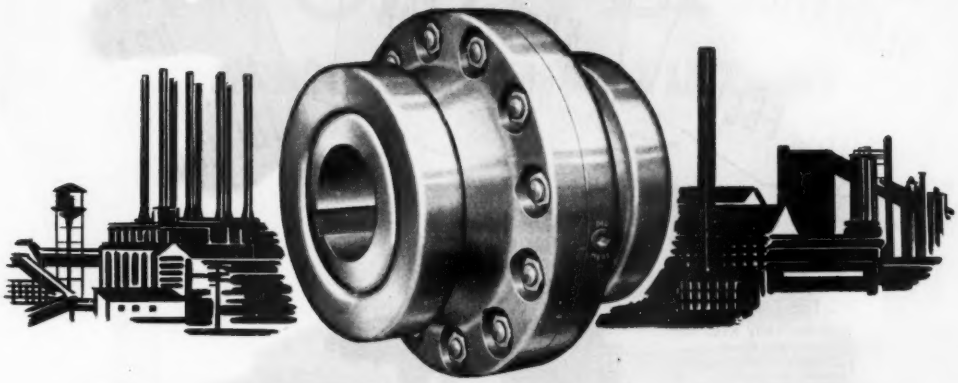
ELGIN
Economical WATER CONDITIONING FOR EVERY NEED
SINCE 1908

ELGIN WATER SOFTENER

Gives Up to 44% More Soft Water

Where new equipment is required, the advanced Elgin "Double Check" Water Softener is your best buy. Compared with others it delivers up to 44% more soft water; prevents costly zeolite loss; costs less to buy and operate. Ask for Bulletin 610.

you can FORGET COUPLING SHUTDOWNS—



INDUSTRY REPORTS—

KOPPERS ENGINEERING STOPS COSTLY FAILURES

These FAST'S COUPLING *Services save you money!*

UNSURPASSED ENGINEERING . . . *Koppers Engineers are acknowledged the best in the coupling industry. Their practical knowledge, backed by 30 years of coupling experience, is at your service!*

LOWEST COST PER YEAR . . . *Fast's Couplings will outlast equipment they connect if properly maintained. Their cost may be spread out over 25 years or more, offering you lowest coupling cost per year!*

In oil fields, steel mills, power plants . . . all through industry . . . cost-wise executives report that *Fast's Couplings*, designed, manufactured and guaranteed by Koppers, are the best insurance against coupling failures! Take a tip from these users who know. Specify Fast's and forget *your* coupling problems!

By specifying Fast's, you get the benefit of Koppers Engineering Service, acknowledged best in the industry. Koppers Engineers, backed by 30 years coupling experience, study your problem . . . then show you *which* Fast's Coupling fits your application, (and more important) *why* you need it!

Only Koppers can offer you this valuable service . . . only Koppers offers Fast's, the original gear-type coupling. Fast's Couplings assure you freedom from expensive coupling failures in your plant because Fast's have no perishable parts to fail!

GET THE FACTS: Mail coupon today for your free copy of the Fast's Coupling Catalog, published by Koppers. Shows how Fast's operate, describes the many sizes and types. Gives full details about Koppers Engineering Service. Send for your copy today.

KOPPERS **FAST'S**

THE ORIGINAL GEAR-TYPE

Couplings

FREE CATALOG

KOPPERS CO., INC., *Fast's Coupling Dept.*, 221 Scott Street, Baltimore 3, Md.

Please send me a free copy of your Fast's Coupling Catalog.

Name.....Title.....

Company.....

Address.....

City.....Zone.....State.....

AUTOMATIC REGULATION OF FUEL FEED

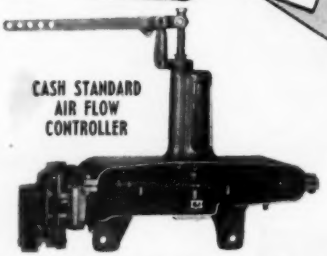
METERED AIR NEEDED FOR COMBUSTION

A CONSTANT DRAFT MAINTAINED IN THE COMBUSTION CHAMBER

CASH STANDARD FUEL FEED CONTROLLER . . .

Automatically Regulates Fuel Feed

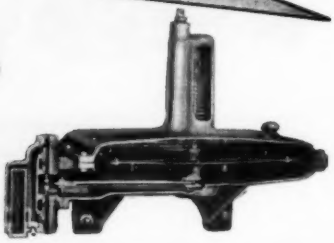
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



CASH STANDARD AIR FLOW CONTROLLER

Meters the Air Needed for Combustion

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



CASH STANDARD FURNACE DRAFT CONTROLLER

Maintains a Constant Draft in the Combustion Chamber

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

THERE'S YOUR *Answer* TO GREATER COST SAVINGS IN YOUR BOILER ROOM . . .

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

You get the cost savings three ways—(1) Less fuel—coal—oil—gas required. (2) Less maintenance requirements whether you have a single boiler or battery of boilers. (3) You get more steam from your present boiler.

The three units pictured are available in a number of variations. Combinations of these units selected in accordance with your specific requirements give you complete automatic control. Installation can be made on any type or size of boiler. It makes no difference whether you have a stoker, pulverizer, oil-burning or gas-firing equipment on your boilers.

Bulletin No. 300
shows applications—tells how the system works in your favor.

SEND FOR IT

Get the facts on the cost-saving Correct Fuel Feed—Correct Fuel Air Ratio—and Correct Over-Fire Draft. See how CASH STANDARD UNITS can be applied to your boiler whether you burn coal, oil, or gas—see why you get immediate and continuous economy in your boiler room.

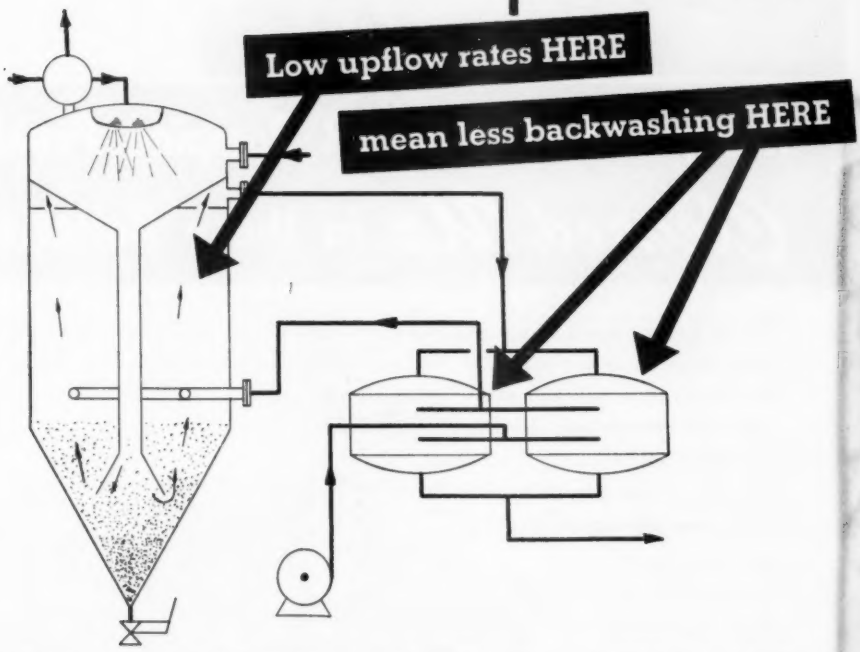
A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS . . VALVES

Why GRAVER

HOT PROCESS SOFTENER FILTERS

Stay Cleaner



Among the many distinctive features of the GRAVER Hot Process Softener is the *low rising rate* of the treated water to the discharge after the softened water has passed through a dense bed of previously precipitated solids.

Compared to other hot process softeners, the GRAVER design provides as low as *half* the rising rate in a softener tank of given diameter and capacity. This means more efficient separation of precipitates and clearer treated water.

Therefore, the GRAVER Hot Process Softener is an effective *clarifier* as well as softener. It imposes less load on the filters . . . the filters stay clean longer . . . far fewer filter backwashings are needed . . . filter maintenance time and expense are greatly reduced . . . and in some instances, such as where a hot zeolite softener is used for second-stage treatment, filters may be unnecessary.

This principle of *more complete removal of precipitated solids within the softener tank* is one of many examples of GRAVER pioneering in water softener designs. For complete information on *all* the GRAVER Hot Process Softener advantages, write for Bulletin WC 102.

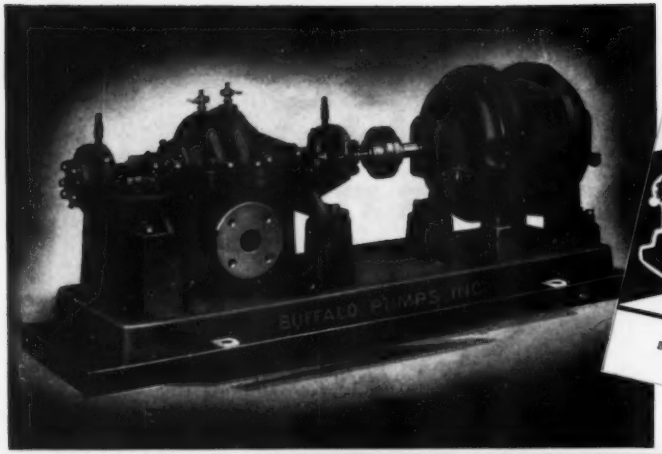
GW-427

GRAVER

GRAVER WATER CONDITIONING CO.

216 West 14th Street, New York 11, New York, U. S. A.

A DIVISION OF GRAVER TANK & MFG. CO. INC. EAST CHICAGO, IND.



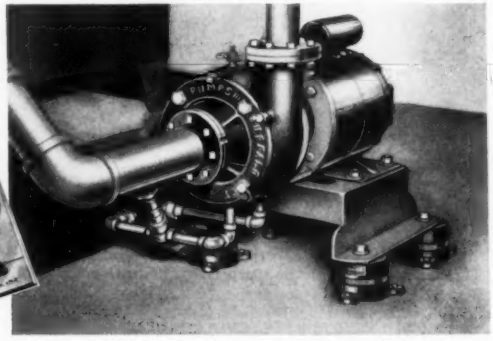
—for handling clear water at high pressures, any temperature
"Buffalo"
Class RR Single Suction Multistage Pumps
BUFFALO PUMPS INC

Many CLEAR WATER Pumping Problems *Cleared Up* in these Bulletins!

IF YOUR concern is with boiler feed or other pressures to approximately 500 lbs. clear water, you will find that "Buffalo" Type "RR" Pumps have the characteristics you want—including high efficiency and long life on the job. BULLETIN 980-B, above, gives all engineering data.

For cramped quarters, you'll find "Buffalo" Close-Coupled Pumps pack a lot of capacity to the cubic inch. Vertical or horizontal installation. BULLETIN 975-B, below, has the facts on these sturdy, efficient pumps.

WRITE FOR YOUR FREE COPIES!



"Buffalo" PUMPS

BUFFALO PUMPS INC.

488 BROADWAY BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont.

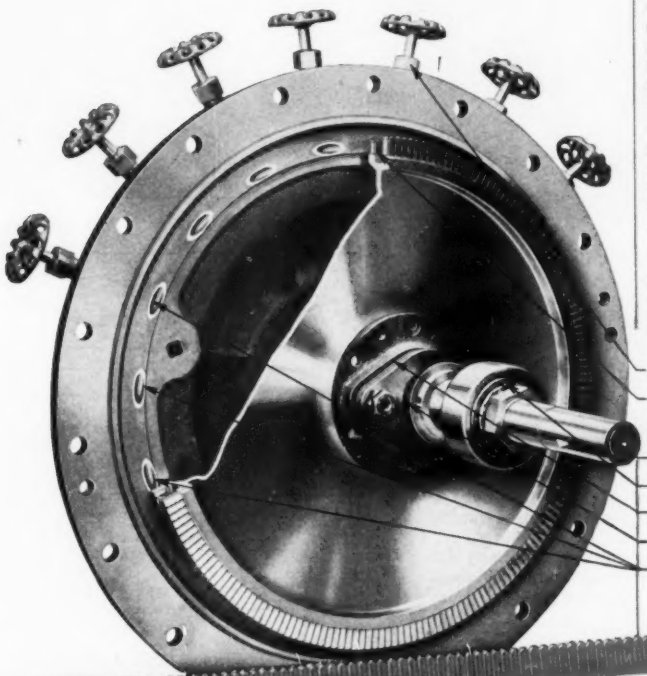
Branch Offices in All Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



- 7 hand valves for efficient partial load operation, (20" turbine shown)
- 2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced
- 30-40 carbon steel shaft
- Oversized double row deep grooved ball bearing
- Stuffing box with metallic packing ring
- Heavy chrome plating of shaft through stuffing box
- 3 nozzles always open

Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

WRITE FOR BULLETIN 135

COPPUS ENGINEERING CORP., 161 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER.

COPPUS "BLUE RIBBON" TURBINES

AMAZING "Ultrasonic" EYE

Sees Through Metal

at
Pittsburgh Piping
AND EQUIPMENT COMPANY

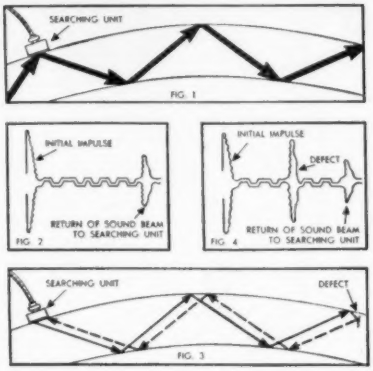
The illustration above shows P.P.&E. high pressure, high temperature piping being tested by means of a Reflectoscope which produces pulses of vibration waves of a frequency above hearing and transmits them at an angle into the metal through a searching unit which contains a sensitive quartz crystal.

The slightest discontinuity in the metal interrupts transmission of the waves, reflecting them back to the searching unit where the crystal converts mechanical vibrations into electrical energy. This voltage, amplified in the receiver, produces a visual indication of the defect on the screen of a cathode ray tube.

This unique testing method can detect flaws that can be found by no other non-destructive test. Its use assures quality control of materials and welding.

Look to Pittsburgh Piping and Equipment Company for leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

How the *"Ultrasonic"* Eye Works



Intermittent ultrasonic vibrations are transmitted angularly into the section under inspection, so that each sound beam is reflected away from its point of origin progressively from inner to outer pipe wall surface in a consistent pattern, as shown in Fig. 1, until it circles the pipe and returns to the searching unit. The uninterrupted flow and return of the beam is indicated on the oscilloscope screen as diagrammed in Fig. 2. Any discontinuity in the metal lying in the path of the sound beam will interrupt transmission as shown in Fig. 3, reflect the sound back to the searching unit, and provide a visual indication of its presence and location on the oscilloscope screen (see Fig. 4).

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street — Pittsburgh, Penna.

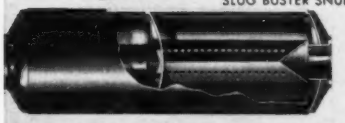
Reduce Engine Exhaust and Compressor Intake Noise—with

BURGESS-MANNING SNUBBERS

In every field of industrial activity where noise, gas surging, or harmful engine or compressor vibration cannot be tolerated, you will find Burgess-Manning Snubbers. Snubbers prevent noise by smoothing the intake air and dissipating the energy in the exhaust gas slugs, providing quiet operation without affecting performance. Write Burgess-Manning, today, for information.

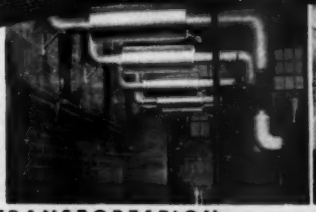
BURGESS-MANNING COMPANY • LIBERTYVILLE, ILLINOIS

SDG
SLUG BUSTER SNUBBER

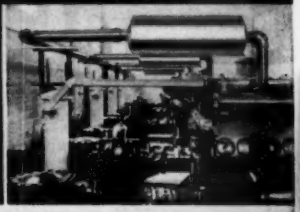


UTILITIES

Sewage Treatment Plant



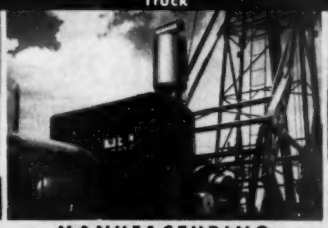
Pumping Station



TRANSPORTATION

Train

Truck



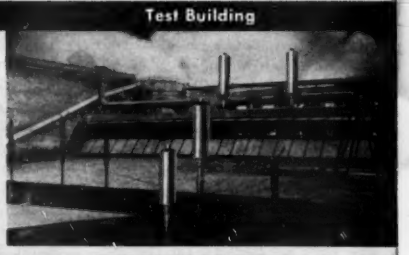
Tug

MANUFACTURING

Compressed Air System

SNUB THE SLUG AND STOP THE NOISE

Test Building



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Recycling Plant

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For Quiet Telephoning . . . Burgess-Manning ACOUSTI-BOOTH

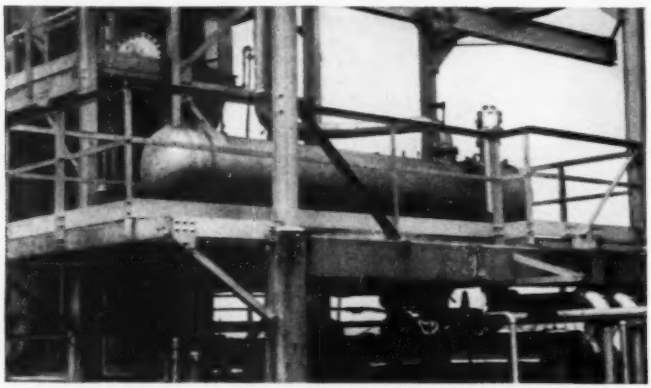
Thick walls of sound-absorbing material soak up noise. You can hear easily . . . talk comfortably in noisy surroundings. Suited to any location. Modern in appearance. Wall and floor models. Doorless.

BRIDGEPORT BRASS COMPANY

CONDENSER TUBE EDITION

COPPER ALLOY BULLETIN

"Bridgeport" BRASS CO. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND. — IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL



Overhead Condenser in large eastern refinery equipped with Duplex tubing—steel outside, Admiralty inside.

Have You Considered Duplex Tubes —for Increased Service Life?

Are all engineers fully aware of the possibilities of Duplex tubes for longer service life and better heat transfer? Some who have tried them only recently regret that they had waited so long before receiving their benefits.

Duplex or double-walled tubing of two entirely different metals was developed to overcome difficult corrosion problems that cannot be readily solved by the use of single-walled tubes.

No doubt the outstanding classical example of the superiority of Duplex tubing is its use in connection with ammonia. For years the maintenance and replacement of steel in refrigeration piping in ammonia systems was a serious one. The steel was attacked by rusting on the water or brine side but it was very satisfactory on the ammonia side. On the other hand, copper and brass which possess excellent resistance to corrosion from water are unsatisfactory in contact with ammonia. Consequently, Duplex tubes with steel to the ammonia side and copper to the water side are ideal for this application.

Not only has freedom from rusting eliminated periodic cleaning and frequent replacement, but the higher heat transfer properties of copper/steel Duplex as compared to steel piping, often results in lower power costs for pumping. On new equipment the greater heat transfer rate permits the use of less tubing and corresponding reduction in size of equipment. Duplex tubes (copper/steel) are also widely used in heat exchange equipment for the manufacture and handling of amino compounds which behave similar to ammonia solutions from a corrosion standpoint.

Ammonia in Product

Ammonia even in small amounts, found in petroleum products produced during processing or intentionally added to neutralize acidic substances, sometimes gives trouble to brass tubing —Admiralty, aluminum brass, or Muntz metal. Some refineries have switched to cupro-nickel (70-30) and report about twice the life of Admiralty in this service. Duplex tubing with plain low carbon steel or Type 304 stainless steel on one side and copper or a copper-base alloy is often satisfactory for this condition.

Sulphur in Product

Hydrogen sulphide and other sulphur compounds present in some petroleum liquids or gases, are very corrosive to copper and high copper alloys. A brass tube alloy such as Muntz metal which contains about 60% copper and 40% zinc or Admiralty are appreciably more satisfactory than the higher copper alloys. Steel sometimes stands up better, from the oil or gas side, than the copper-base alloys, but rusts or corrodes from the water side. Here in many instances Duplex Tubing—steel to the petroleum side and Admiralty, Cupro Nickel or brass to the water side —is working out very satisfactorily.

Other Applications

There are many places where Duplex Tubes will outlast single-wall tubing. Consequently, they should be considered if only in the interest of conserving metals.

Lube Oil Coolers—used in manufacturing lubricating oils or in cooling oils in diesel engines, turbines, motors. Duplex-aluminum outside—copper inside —replace either copper or steel tubing.

Fuel Oil Heaters — thinning down heavy fuel oil previous to being atomized and burned. Duplex—copper outside, steel inside.

Cyanides—Organic or Inorganic—for chemical operations involving these chemicals. Duplex with steel outside and copper inside is recommended.

Boiler Duplex Tubes, Steam Generators — replacing ordinary steel boiler tubing in the rebuilding and construction of boilers and generators. The copper is surrounded by water in Duplex—copper outside, steel inside. Hot gases are in contact with the steel.

Hot Sulphuric Acid Solutions—heating or cooling sulphuric acid solutions. Duplex—lead outside, copper inside to the steam side or cooling water.

Much technical information on Duplex tubes—combinations of metals and the applications and methods of installing—can be found in the Duplex Tubing Technical Bulletin No. 1950. Write for your copy. If you have a serious corrosion problem involving tubing, please fill out the questionnaire on page 2 of the aforementioned bulletin and send it to our nearest office. Our Laboratory may already have information which has solved a similar problem. (6157)

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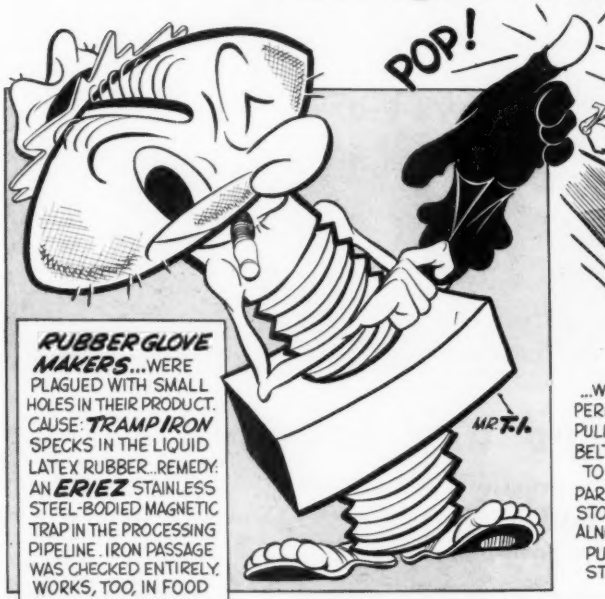
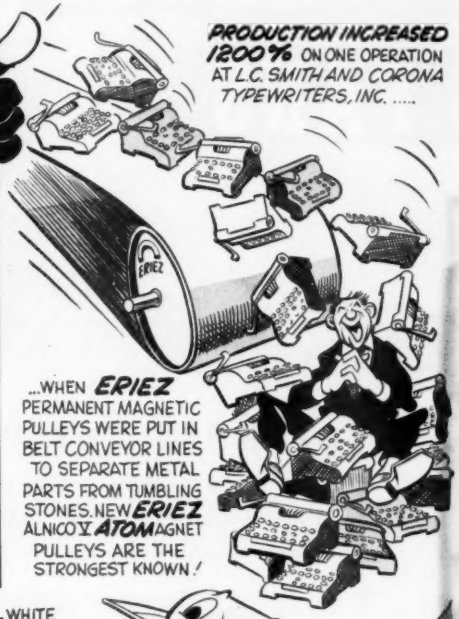
ERIEZ MAGNETIC ATTRACTIONS

ERIEZ MANUFACTURING CO, ERIE, PA., U.S.A. • PRODUCERS OF MAGNETIC SEPARATORS AND SELLERS OF (RCA) ELECTRONIC METAL DETECTORS



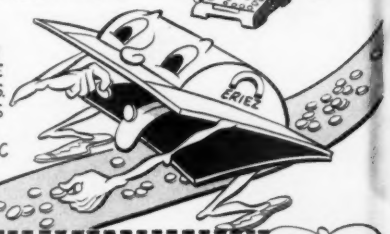
RUBBER GLOVE MAKERS...WERE PLAGUED WITH SMALL HOLES IN THEIR PRODUCT. CAUSE: **TRAMP IRON** SPECKS IN THE LIQUID LATEX RUBBER. REMEDY: AN **ERIEZ** STAINLESS STEEL-BODIED MAGNETIC TRAP IN THE PROCESSING PIPELINE. IRON PASSAGE WAS CHECKED ENTIRELY. WORKS, TOO, IN FOOD LINES OR IN ANY LIQUID FLOW LINE.

PRODUCTION INCREASED 1200% ON ONE OPERATION AT L.C. SMITH AND CORONA TYPEWRITERS, INC. .....



...WHEN **ERIEZ** PERMANENT MAGNETIC PULLEYS WERE PUT IN BELT CONVEYOR LINES TO SEPARATE METAL PARTS FROM TUMBLING STONES. NEW **ERIEZ** ALNICO V **ATOM** AGNET PULLEYS ARE THE STRONGEST KNOWN!

FOR SORTING PENNIES...WHITE (STEEL) ONES FROM COPPER....U.S. MINTS IN PHILADELPHIA AND SAN FRANCISCO CHOSE POWERFUL **ERIEZ** MAGNETIC SEPARATORS. **ERIEZ** NEW PERMANENT PLATE MAGNETS ....KNOWN AS **ATOM** AGNETS.....SEPARATE ALMOST ANY MAGNETIC FROM NON-MAGNETIC MATERIAL.



METAL IN CORN FLAKES... CAN BE TOUGH ON TEETH AND STOMACH. TO KEEP ALL METAL OUT OF ITS CEREAL PRODUCTS, *GENERAL MILLS* USES THE R.C.A. ELECTRONIC METAL DETECTOR, SOLD BY **ERIEZ**. IT WARNS AGAINST ANY METAL AS SMALL AS .039" IN DIAMETER!

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MY CONTAMINATION OR SEPARATION PROBLEM IS:

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HAVE REPRESENTATIVE CALL ☐ PROMPTLY ☐ WHEN IN AREA

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STREET _____
CITY _____ ZONE ___ STATE _____

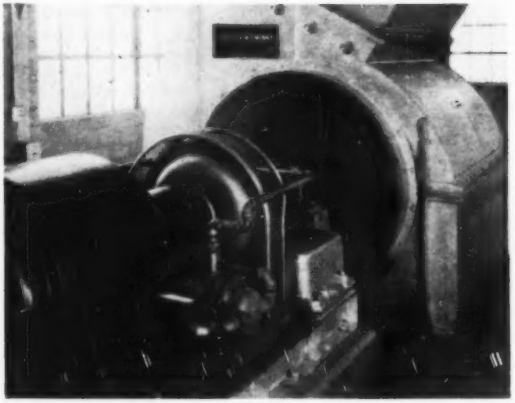
51A

Consumers Power *Again* Selects

CLARAGE FANS

. . . for Both Forced and Induced Draft

Built in 1940 — enlarged to practically twice capacity in 1949 — and *both times* Clarage HEAVY-DUTY equipment was chosen for mechanical draft in this John C. Weadock plant, Bay City, Michigan.



One of the four Clarage forced draft fans; each 100,000 c.f.m. at 12" S.P. There are also two Clarage induced draft fans included in this latest Weadock power plant installation; each with a capacity of 330,000 c.f.m. at 17" S.P., 350° F.

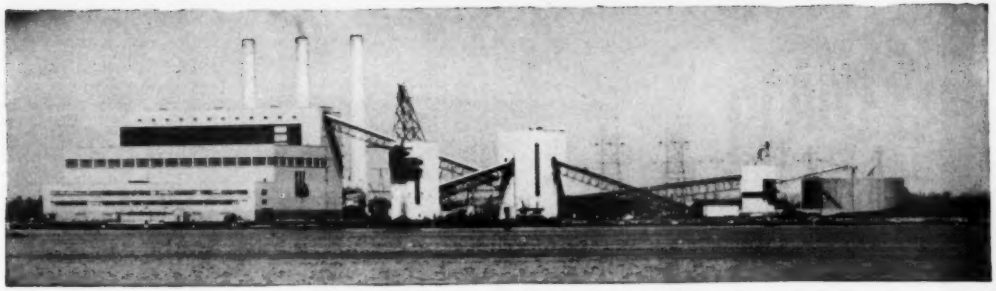
All told, Consumers Power Company has had 24 years of experience with Clarage forced and induced draft fans. Other installations include: East Ave. Station, Kalamazoo (1926); Elm St. Station, Battle Creek (1938); Bryce C. Morrow Station, Comstock, Michigan (1939).

Specialists in this exacting field of mechanical draft, we have facilities to meet all requirements. To date over 3,000 power plants are Clarage equipped. If you are looking for the *best in performance* and *dependability*, it will pay you to consult with us.

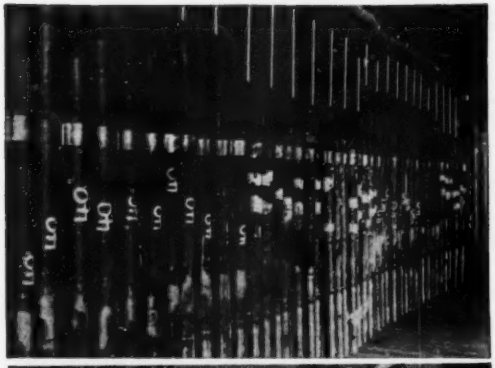
CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

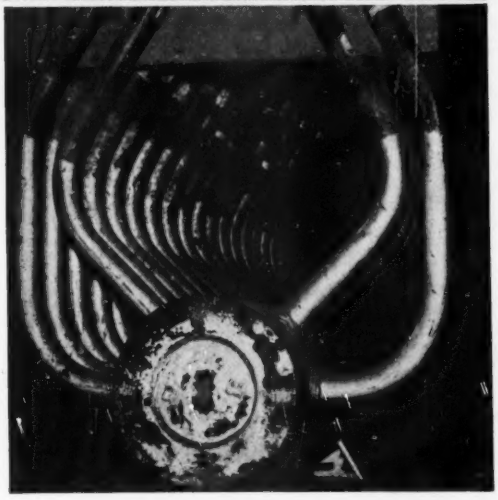
CLARAGE
—HEADQUARTERS for Air Handling and Conditioning Equipment

Sales Engineering Offices in All Principal Cities



A new high in boiler efficiency





Sewaren uses 1500 psig 1050-F steam and Boiler Tubes of U·S·S Stainless Steel

● The Sewaren Generating Station* is a modern miracle of efficient design. Plant heat rates improve steadily as each new unit goes on the line.

National Seamless Boiler Tubes, made from heat-resistant U·S·S Stainless Steel, have an important place in this new generating station. They permit the continuous, high-pressure, high-temperature operation that is absolutely necessary for most efficient power production. These tubes lend themselves well to the most complicated fabrication. Furthermore, the outstanding corrosion-resistance of National Stainless Boiler Tubes is solid assurance of long, trouble-free service . . . lower maintenance costs . . . *less down time.*

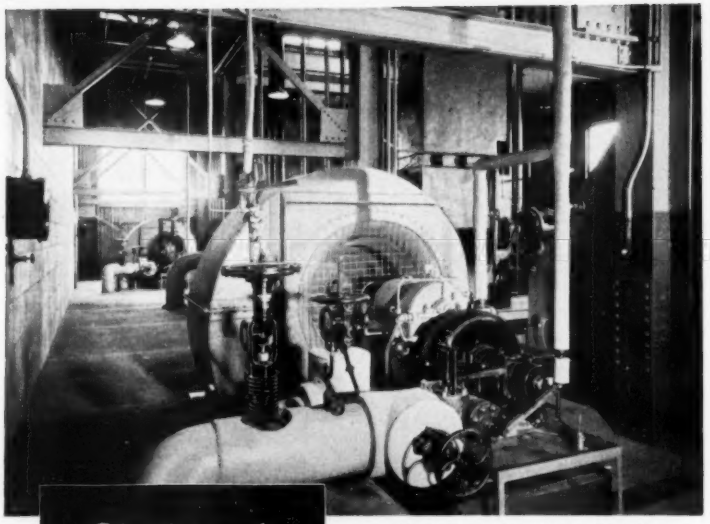
Take a tip from the men that planned this nationally-known generating station: For new boilers, or for re-tubing jobs, use National Seamless throughout. National Seamless Tubes are pierced from solid billets of steel . . . the *only* process that completely removes all uncertainty regarding uniform wall strength.

*Public Service Electric and Gas Company, Newark, New Jersey.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
(Tubing Specialties Division)
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

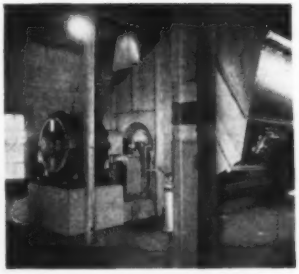
NATIONAL *Seamless*
BOILER TUBES
UNITED STATES STEEL



Two Sturtevant Forced Draft Fans in the Calco Division's Willow Island powerhouse.

AT AMERICAN CYANAMID ...IT'S

Sturtevant FANS



The Sturtevant Induced Draft Fan on No. 8 boiler, Calco Division, Bound Brook, N. J.

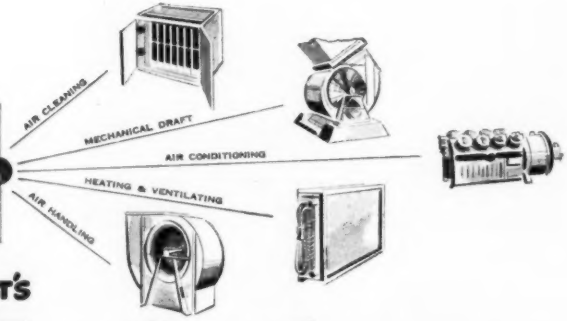
Why? Because years of reliable, on-the-job service by Sturtevant Fans have built a reputation for sound, economical performance among power plant designers and engineers. These installations, at two of American Cyanamid's Calco Chemical Division plants, are typical of the Sturtevant Fans found in almost every major power plant in this country.

Sturtevant offers a wide variety of proven equipment. There's the E-R (Erosion-Resisting) Wheel, which gives *two to four times longer life* than standard induced draft fan wheels, or VANE CONTROL® to regulate exact pressure and volume output at great savings in power.

For full information, contact your nearest Sturtevant office, or write Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

PUTTING *Air* TO WORK

Only Westinghouse offers a *complete* line of air handling, air cleaning and air conditioning equipment.



YOU CAN BE SURE...IF IT'S

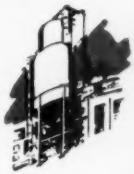
Westinghouse

I-80208

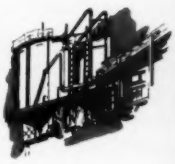
PERMUTIT PRODUCTS for POWER PLANTS

ZEO-KARB SOFTENER. The Permutit Zeo-Karb® Softener removes both hardness and bicarbonates from raw water. The effluent is soft and reduced in total solids and alkalinity. Sulphate-carbonate ratio may be adjusted as desired by a system of mixed effluents.

SILICA REMOVAL PLUS DEMINERALIZATION. Demineralization by cold ion exchange processes produces water of comparable quality to distilled water at a fraction of the cost of distillation. Treatment by an anion exchange resin, Permutit S®, reduces silica to less than 0.2 ppm.



DEAERATING HEATER. The Permutit Deaerating Heater, utilizing exhaust or bled steam, prevents corrosion of feed lines, stage heaters, economizers, and boilers by removing oxygen and free CO_2. Capacities from 12,000 to 1,400,000 pounds per hour are in service.



SLUDGE BLANKET HOT LIME SODA. The application of the sludge blanket design to hot lime soda treatment gives you soft water of a low silica content. **HOT ZEOLITE.** Subsequent treatment by Permutit Q® yields a final zero-hardness effluent.

PRECIPITATOR. The Permutit Precipitator is used to lower alkalinity, reduce hardness, and help to remove turbidity. It can also be used to reduce silica.

These basic processes–plus Permutit skill–can solve your water conditioning problem

Whatever your water treatment problem, Permutit offers all types of equipment and minerals that can supply soft, clear, chemically correct water for your plant. Write for full information to The Permutit Company, Dept. P-1,330 West 42nd Street, New York 18, N. Y., or to Permutit Company of Canada, Ltd., Montreal.

Permutit®

FOR OVER 37 YEARS

WATER CONDITIONING HEADQUARTERS

...thank you!

AMERICAN CYANAMID CO.

AND YOUR PLANT ENGINEERING GROUP

Thank you for your many purchases of Milton Roy Controlled Volume Chemical Pumps over the past ten years, and for your courtesy in permitting us to run this announcement for all the world to see.

American Cyanamid was one of our first big-name customers . . . now has well over one hundred units in plants from Florida to California.

These Milton Roy units include "Package" systems for chemically treating boiler water and mill water supplies, Automatic Chemical Feed Systems and other Controlled Volume Pumps for various chemical pumping and metering applications. May we serve you, too?

MILTON ROY COMPANY

1305 E. Mermaid Lane, Philadelphia 18, Pa.

Milton Roy Pumps are installed at following American Cyanamid Co. plants:

Acco, Fla.	Charleston, W. Va.	Linden, N. J.
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Bound Brook, N. J.	Grasselli, N. J.	New Castle, Pa.
Brewster, Fla.	Hamilton, O.	Pearl River, N. Y.
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"Proper maintenance can increase conveyor belt life more than 50%. We keep our Republic Record Maker Belt centered to avoid unnecessary edge rub."

"Republic Record Maker may be the right conveyor belt for your job, too. Give us a call and we'll soon find out. Republic Distributors like me make free analyses of every job. Our recommendations save you money."

Try Republic First...

REPUBLIC CONVEYOR BELTS SAVE LABOR

"Our lumber company greatly reduced labor costs with Republic Record Maker Conveyor Belting. At one spot alone, where rough oak planks are unloaded from boxcars, work efficiency has increased four times. The belt, in operation for more than 4 years, has long since paid for itself."

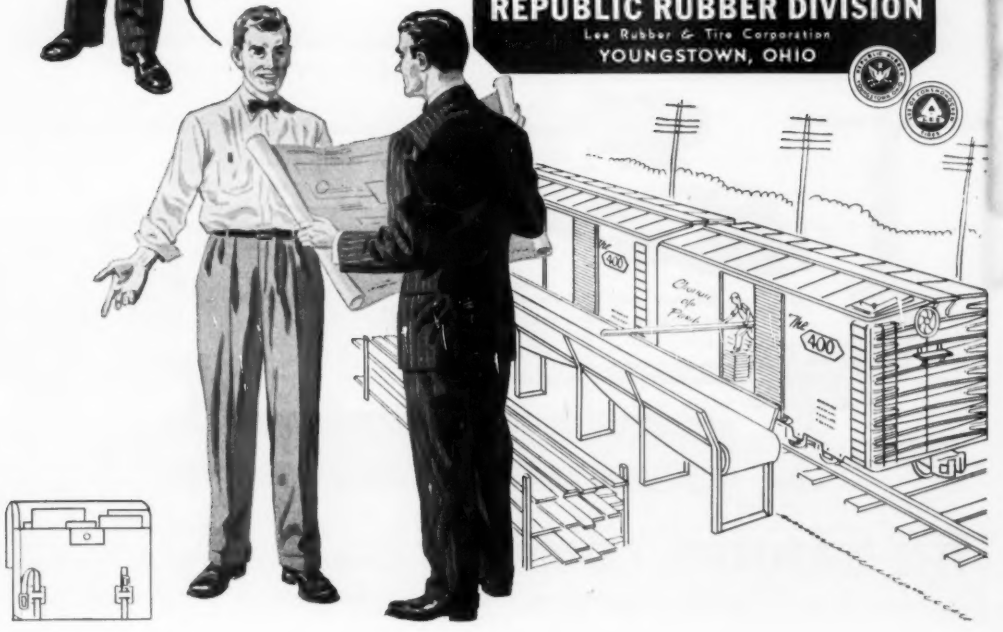
Republic Conveyor Belts eliminate hours of tough, unnecessary labor on the job. Republic Products, like the lumber-hauling Record Maker Conveyor Belt shown below, are made of quality materials especially chosen to give extra performance at minimum cost. Your Republic Distributor is an expert analyst who can quickly tell which of the hundreds of Republic Industrial Rubber Products is best suited to your line of work. Contact him today, or write us direct. Remember, for a half-century the Republic name has stood for performance through quality. For best results "Try Republic First!"

INDUSTRIAL RUBBER PRODUCTS BY

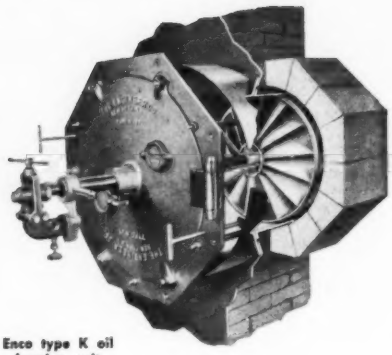
REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation

YOUNGSTOWN, OHIO



ENCO
OIL and GAS
BURNER UNITS



Enco type K oil burning unit

High load or low, you can count on completely uniform combustion and greater fuel economy with the Enco Type K Oil and Gas Burner Unit. It is flexible three ways . . . (1) designed for use with either oil or gas—or both, (2) flexible where steam demands swing sharply and (3) can be operated by either natural or forced draft.

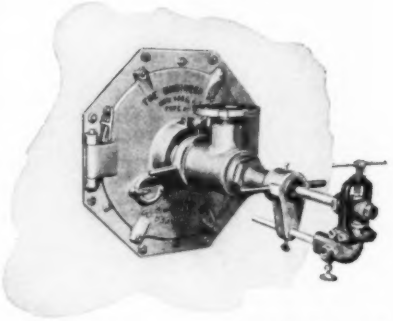
ENCO BURNER UNITS ARE MADE in many sizes to suit all capacity requirements.

Enco Interchangeable Atomizers

Wide Range Mechanical—Capacity range of 10 to 1. Manual or automatic control. Constant high oil pressure at atomizer insures efficient atomization over entire load range without recirculating or returning oil.

Steam or Air—Capacity range of 10 to 1. Controlled by manual or automatic pressure regulation.

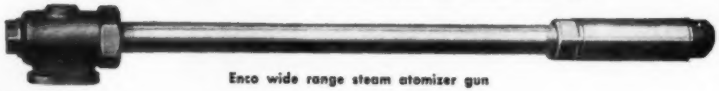
Standard Range Mechanical—Available in all sizes to suit load and capacity requirements.



Enco type K gas-oil burning unit

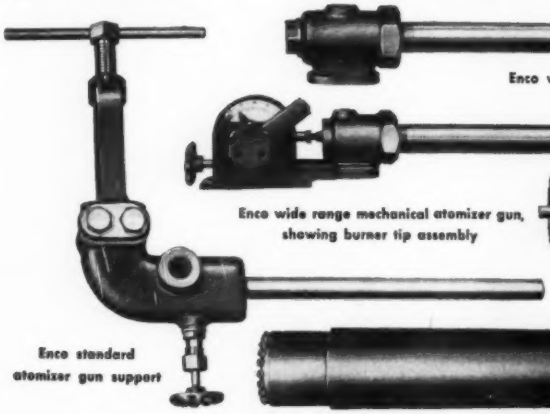
BULLETINS ON REQUEST
WRITE TODAY

Enco standard range mechanical atomizer gun



Enco wide range steam atomizer gun

Enco wide range mechanical atomizer gun, showing burner tip assembly



Enco standard atomizer gun support

Enco gas burning gun

EC-482

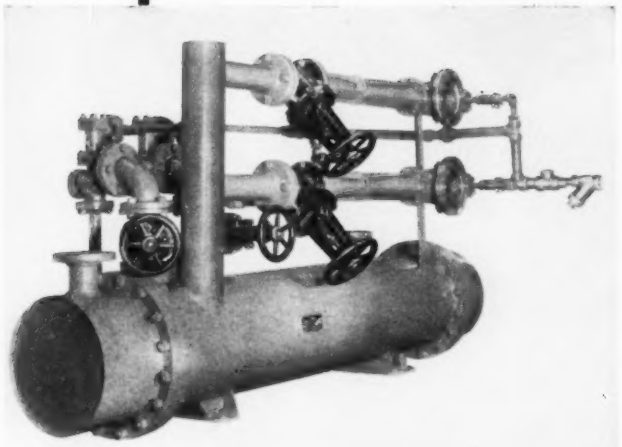
THE ENGINEER COMPANY 75 WEST STREET, NEW YORK 6, NEW YORK

IN CANADA: F. J. RASKIN, LTD., 4220 IBERVILLE ST., MONTREAL 34 P.Q.

CONSECO STEAM JET AIR EJECTORS

selected for new

STATEN ISLAND - NEW YORK FERRIES



Each unit is a twin element, 2-stage high capacity Steam Jet Air Ejector with combined surface type inter- and after-condensers. Three of these units have been furnished for installation in the new Staten Island Ferries being built by the Bethlehem Steel Company at their Mariner's Harbor yard.

The special arrangement of ejector elements was made to fit the limited space available for the installation.

This is a typical example of the close liaison and cooperation between Conseco engineers and the purchaser to achieve the best arrangement commensurate with good marine engineering practice.

•

Other CONSECO equipment aboard these ferries includes Condensers, Feed Water Heaters and Drain Coolers.

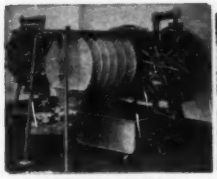
•

Write for Bulletins covering Ejectors, Evaporators, Condensers, Coolers, Boilers and Pumps.

BOILERS

DEAERATORS

CLOSED HEATERS



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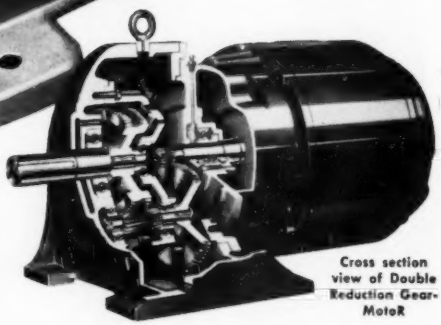
HOBOKEN, N. J.

ANY SPEED YOU NEED

1 TO 60 H.P.

WITH THE PHILADELPHIA GEARMOTOR

The GearMotoR is a self-contained, compact unit conforming to recommended standards of American Gear Manufacturers Association and National Electrical Manufacturers Association . . . Available in single, double and triple reductions . . . Range of speeds: 780 through 7.5 R.P.M. Motor Rating from 1 H.P. through 60 H.P. . . . A-c or D-c. Motors are precision-built and fit perfectly with Gear Unit. Gears are of helical type . . . alloy steel, wear hardened and arranged in simple train for quiet operation and long life . . . Lubrication is splash-type with large reservoir assuring thorough and constant lubrication to all parts of unit . . . Housing is leak-proof, and of sturdy construction.



Cross section view of Double Reduction GearMotoR

Send for 42 page illustrated GearMotoR Catalog. Contains full details. Please write on your Business Letterhead.

Philadelphia Gear Works, INC.

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Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Buell van Tongeren Cyclones
Can Help You...

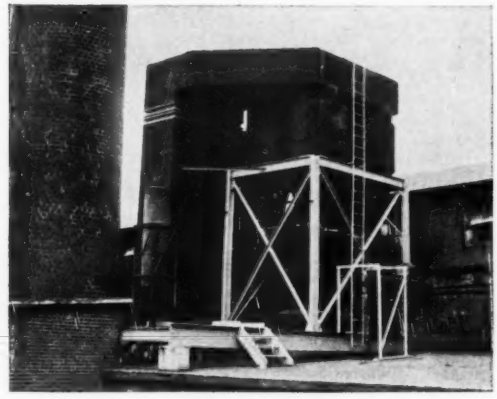
DO A REAL JOB of FLY-ASH COLLECTION on PULVERIZED COAL-FIRED BOILERS!

In plant after plant, where pulverized coal-fired boilers have presented seemingly fathomlesss fly-ash problems, Buell has come up with the answer.

Stated simply it is this: Sustained peak efficiency . . . with the exclusive van Tongeren Cyclone. PLUS—clog-proof, low maintenance construction.

What's more, with a Buell fly-ash collection system *you know your efficiencies beforehand!* You get a true indication of the actual performance of your Buell System—on the job! Performance that has proved capable of meeting even the most stringent demands (of local air pollution ordnances).

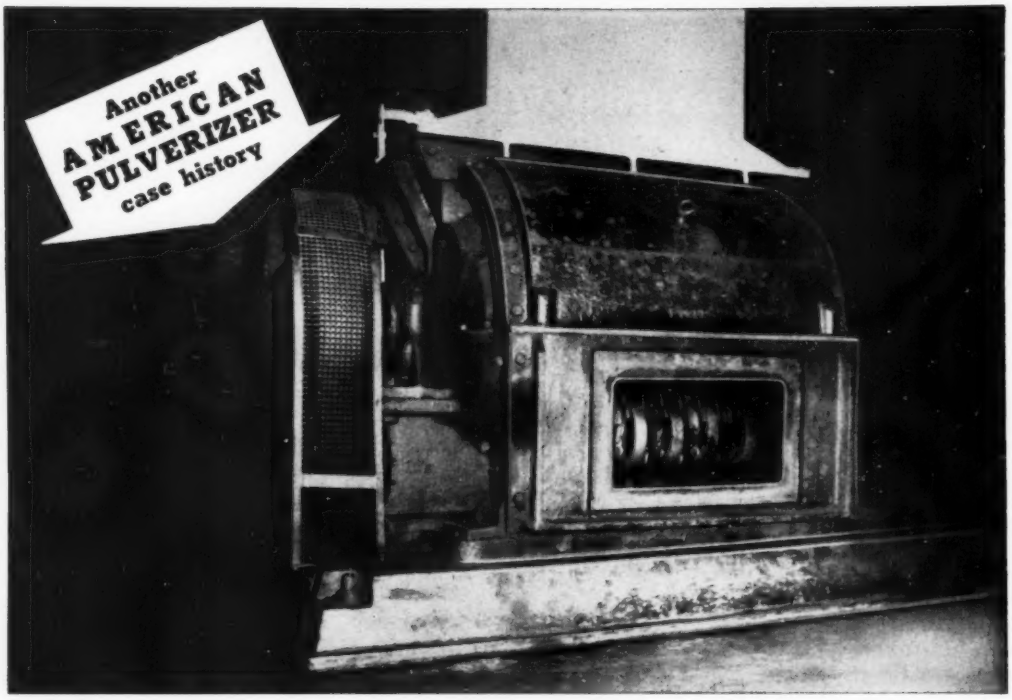
If you have a serious fly-ash collection problem, an inquiry will bring help in a hurry. Please address request for information to: Buell Engineering Company, Suite 5045, 70 Pine Street, New York 5, N. Y.



● After an exhaustive 5-year study, engineers at a Southern paper mill selected Buell van Tongeren Cyclones for their three pulverized-coal-fired boilers.

buell

Engineered Efficiency in **Fly Ash Collection**



20 years ... and 6,000,000 tons later: STILL GOING STRONG

Yes, over 2 decades ago this American Crusher 42S was installed in a New Jersey Central Station. Since then, it has continuously and faithfully crushed more than 6 million tons of coal.

But here is the eye-opening part of this enviable record: during this entire 20-year period, the total parts replacement cost per ton of coal crushed has been only $.00025. (In other words, *40 tons for a penny).*

Even more convincing proof of American Crusher *quality* is the fact that this is a *typical case history*—not an isolated example. An extensive independent survey has revealed over and over again that Americans consistently produce high tonnage for years—at amazingly low parts-cost figures. Discover for yourself why Americans are preferred everywhere for performance, for dependability, and for economy of operation.

WRITE for special "AC Coal Crushing Bulletin"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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TURBINES FOR *Air Conditioning* AT MADISON SQUARE GARDEN

In 1925 Madison Square Garden installed three Terry Multi-Stage Turbines to drive air conditioning and refrigeration compressors. These units deliver 290 hp at 3500 rpm with steam conditions of 100 psi exhausting to a 26 in. vacuum.

After 22 years experience Madison Square Garden installed three more Terry Multi-Stage Turbines, one of which is shown above. This unit delivers 330 hp, at 5650 rpm, with steam at 100 psi exhausting to a 25 in. vacuum.

The same engineering talent and manufacturing facilities that produced these turbines are available to assist you in obtaining efficient power generation.

Any of our District Representatives will be pleased to give you full information on a turbine drive for your requirements. No obligation. May we send you descriptive bulletin?

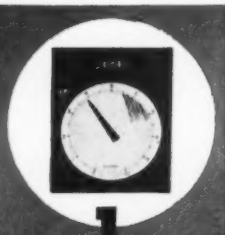
TT 1184

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD. CONN.

4 ways to know your combustion efficiency

The ever-increasing pressure for fuel economy makes some type of "combustion guide" instrument an essential part of any modern fuel burning operation. Hays offers the most complete line of such instruments in the industry—adaptable to your cost and engineering requirements. Your particular needs with regard to price, accuracy, speed of response, etc., will determine your choice—*however, whatever your needs, Hays has the instrument.*

Select your combustion guides *from the most complete line in the industry*



1 HAYS MAGNOTHERM O_2 METER

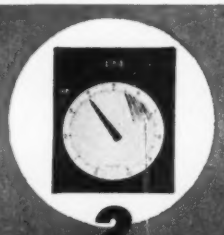
Measures fundamental indicator of combustion efficiency —Oxygen. Electronic in operation, with all of the most advanced features incorporated into its design, it is applicable not only to power plant conditions but also to a host of process problems such as catalytic crackers, open hearths, process heaters, inert gases, etc.

PRINCIPLE

Based on paramagnetic (attracted by magnetism) properties of oxygen. All other gases usually encountered are slightly diamagnetic (repelled by magnetism).

FEATURES

Highly sensitive to change in O_2 content
Rapid response to change in O_2 content
Electrically operated
Electronic type recorder
Temperature controlled
Pressure compensated
No liquid or gaseous fuel required to be added
No chemicals
High accuracy maintained
Not affected by wide change of gas flow rate
Continuous sampling and recording
Glass and corrosive resistant sampling system
Remote mounted analyzer
Remote mounted recorder
12" 24-hour chart
O_2 recorder and indicator
4 records on same chart possible
Low maintenance



2 HAYS CONDU-THERM CO_2 METER

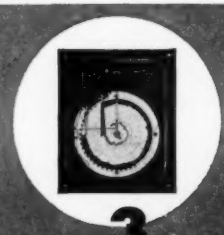
Meter incorporates all of the construction and manufacturing ideas which Hays has developed during many years of experience in gas analysis. A deluxe instrument, the Condu-Therm CO_2 Analyzer is especially applicable to the larger boiler plants and to industrial processes.

PRINCIPLE

The principle of operation used in the Hays Condu-Therm Meter is that of thermal conductivity of gases, i.e., that all gases conduct heat at different rates.

FEATURES

Electrically operated
Electronic type recorder
Temperature controlled
Humidity controlled
No chemicals required
No moving parts in analyzer
Continuous sampling
No drying agent required
Easily installed glass and corrosion resisting sampling system
Not affected by wide change in gas flow rate
Rapid response
High sensitivity
Continuous recording
Remote mounted analyzer
Remote mounted recorder
12" 24-hour chart
CO_2 Recorder and Indicator
As many as 4 records on same chart
Low maintenance



3 HAYS COMBUSTION METER

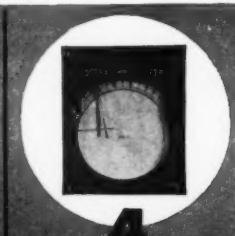
Hundreds of these meters have been in operation for many years in all types of plants burning all kinds of fuels and saving thousands of fuel dollars.

PRINCIPLE

Operates on Orsat principle of Volumetric measurement and chemical absorption. Extremely simple: sample of flue gas trapped and accurately measured; passed through chemical which removes CO_2 component of gas mixture. Sample is re-measured, volume compared to original sample. Difference before and after absorption gives exact percentage of CO_2 absorbed by chemical.

FEATURES

Low price
Water operation
Pressure and temp. compensated
Volumetric determination
Chemical absorption
2 minute operating cycle
Easily understood
Rugged construction
Low maintenance
Available in 6 remote mounted types and 3 integral types
Remote or integral mounting
10" 24-hour chart
Available for: (a) CO_2 only—recording with or without indicator (b) CO_2 and flue gas temperature recorder combined (c) CO_2, draft or flue gas temperature recorder combined



4 HAYS-PENN BOILER EFFICIENCY METER

Provides a QUANTITATIVE guide to efficiency — deals with quantities of air and steam; by contrast CO_2 and O_2 meters are QUALITATIVE guides since they determine directly quality of combustion gases. Both Boiler Efficiency Meter and Gas Analysis Meter are used to obtain advantages of both methods.

PRINCIPLE

Pounds of air required to burn each pound of coal vary widely with heating value of coal; constant weight of air is required to produce same Btu. Similar relationship exists when oil and natural gas are used as fuels. Record of steam flow is assumed to be Btu's produced; record of air flow is calibrated to flow of air required to generate that steam.

FEATURES

Electric operation of flow meter and air flow recorder
Diaphragm type air flow measuring unit
Air flow measuring element does no work
Air flow recorder—motor operated
Adjustable cam air flow calibration
Mercury transmitter—pressures to 2500 psi
Interchangeable range tubes for steam flow
Remote mounted steam flow transmitter
No high pressure piping into panel
Easily installed and adjusted
Low maintenance

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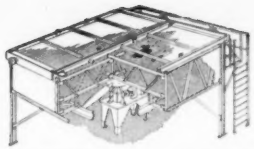
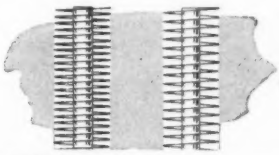
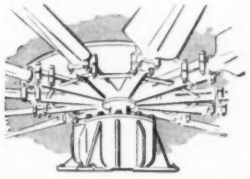
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders



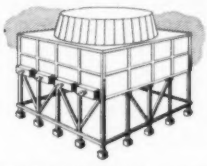
RIGID STRUCTURE . . . truss-sections give rigid but light design — requiring a small, inexpensive foundation. Rigidity assures longer-life coil sections.



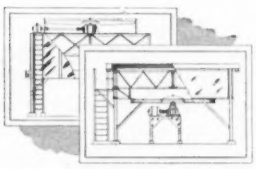
EFFICIENT FINNED TUBES . . . pressure bonded fins on tubes give high level heat transfer not dependent on solder joints. Various fins, tubes and headers available to meet any application.



PROVEN MECHANICAL EQUIPMENT . . . multibladed fans and rugged Geareducers team up to give quiet, smooth and dependable operation . . . regardless of weather or location.

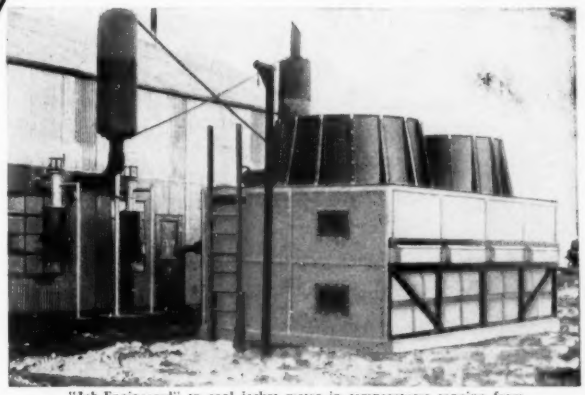


ALTERNATE MATERIALS . . . where corrosion is a problem, asbestos-board casing on a redwood frame requires little maintenance. Redwood, standard in cooling tower design, gives strong, durable and rigid support.



COMPLETE STANDARD LINE . . . induced draft or forced draft — portable or stationary — steel or redwood — various fin and tube materials and arrangements are offered by Marley to meet any application — usual or unusual.

Features like these . . . make MARLEY DriCooler® "JOB-ENGINEERED"



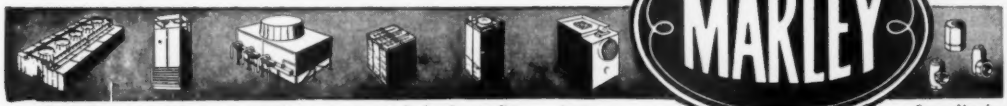
"Job-Engineered" to cool jacket water in temperatures ranging from —40F to 100F, an induced draft, asbestos-covered redwood structure.

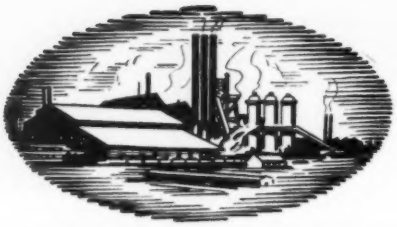
No single design in an air-cooled heat exchanger will suit all applications. Cooling jacket water in below-zero temperatures, condensing gasoline on the sea coast or serving a pipeline compressor station in the desert . . . each is an exacting application . . . each requires a different type of unit. And that's why Marley has a complete line of DriCoolers available in all sizes and in a wide range of designs and materials.

After considering all factors, such as the fluids to be cooled — first cost — horsepower cost — weather conditions — corrosion and many other factors, Marley can make the best and most economical recommendation for your job.

Whether your job requires forced draft or induced draft design, steel or asbestos-board covered redwood structures, special fin or tube materials, you can be sure that your Marley DriCooler is "Job-Engineered" for your specific application.

Let your Marley Application Engineer work with you from the "blueprint" stage on. Write, The Marley Company, Inc., Kansas City 15, Kans.





1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes.

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- Since 1900 we have increased our supply of machine power 4½ times.
- Since 1900 we have more than doubled the output each of us produces for every hour we work.
- Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

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B-L's TEXAD* replaces plate, improves furnace efficiency

Eases steel requirements

● TEXAD* eliminates the nuisance of steel plate casings for boilers and other industrial furnaces. As a result, steel quotas can now be devoted solely to pressure parts. TEXAD*—a canvas sheathing impregnated with a specially developed heat-resistant adhesive—is applied directly to the insulation surface, hung just like wallpaper.

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● The canvas and adhesive finish provides a completely air-tight furnace. Because of its flexible sheathing, TEXAD* prevents shrinkage cracks in the finish coat of insulating cement and acts as a safeguard against air leakage.

Cuts material, labor costs

● The material and labor expense of installing steel casings is greatly reduced by TEXAD*. Some of the resulting savings can be used to secure sounder construction back of tubes for a more balanced furnace design. The net result is a better enclosure—at a much lower cost.

Provides complete weatherproofing

● Because TEXAD* enclosures are completely waterproof, outdoor installations are not affected by rain, snow or sleet. Indoor installations can be washed down at any time. Final jobs can be painted any color, or left white.

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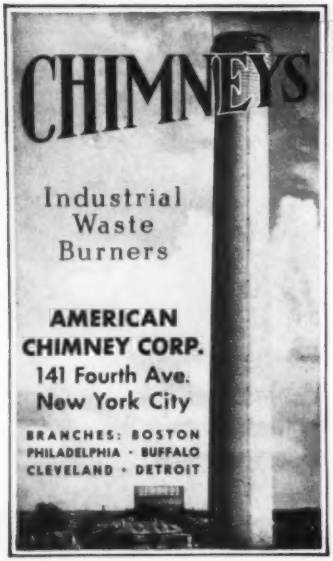

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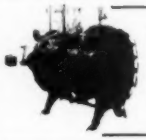

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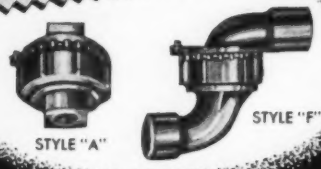

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the answers to
"What's available?"
"Who makes it?"
"Where can I get it?"
—you'll find them quickly
and easily in the

1950 Mid-June
POWER Buyers' Guide Number
KEEP AND USE *YOUR* COPY

Badger expansion joints
help N. Y. Steam Corp. cut maintenance on about 75 miles of steam lines

When a Gothamite wants steam — unlike water — there's no shortage, New York Steam Corp. provides it instantly. From Battery to 92nd Street this gigantic system — the world's largest — at peak loads can serve over 10,000,000 pounds of steam per hour to about 3,000 Manhattan buildings. (See "The Heat's On in New York," Business Week, Jan. 14, '50)

Maintenance costs could easily get out of hand in such a vast underground system. Best protection? — The best equipment. And in Expansion Joints that means Badger. Since the early 1900's New York Steam Corp. has installed thousands of these famous joints — and maintenance costs have been kept to a minimum.

These construction features on Badger Joints can cut your costs too:

- **Directed-flexing rings . . . equalize stresses *between* and *within* corrugations**
- **Packless . . . pressure-tight single tube**
- **Compact . . . no larger than flanged fitting**
- **Special forming . . . no structure-weakening stresses**
- **Controlled heat treating . . . assures long life**
- **Fabricated from copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion**

How about your expansion joint problems? Are you getting less than the best in performance? . . . In low cost operation? Then there's good news for you in the Badger story — write for details today.

Badger MANUFACTURING COMPANY
230-260 BENT ST. • CAMBRIDGE 41, MASS

Graduate ENGINEERS

GOOD OPPORTUNITIES FOR

INSTRUMENTATION ENGINEERS: Five or more years of progressively difficult experience in Instrument Research Development or Design. Must have broad and thorough knowledge of instrument theory and application. Should have some knowledge of Chemical Equipment and its operation. Must be graduate.

POWER ENGINEERS: Must have five to fifteen years' experience in some of the following: operating, testing and maintaining power plant equipment, supervising power plant operations, making cost and evaluation studies, heat balance work, power cost accounting, design and layout of power plants, and the selection and installation of power equipment. Must be graduate.

AIR CONDITIONING ENGINEERS: At least 7 years' experience in selection and operation of heating, air-conditioning, ventilating and refrigeration equipment. Well versed in the theory of thermodynamics, fluid flow and heat transfer. For consulting evaluation, and economic operation services. Must be graduate.

HEATING AND VENTILATION ENGINEERS: Eight to ten years progressively difficult experience in field and office problems in heating, ventilating and air-conditioning design. Also, experience in making economical evaluation of alternate methods. Must be graduate.

ELECTRICAL ENGINEERS: Must have eight to twelve years' broad and thorough experience in electrical design and operating problems of industrial plants with thorough knowledge of selection, installation, economical operation and maintenance of electrical equipment. Must be graduate.

MECHANICAL IMPROVEMENT ENGINEERS: Five or more years' experience in Machine Design and Development. Mechanical Improvement work involving Stress Analysis, Lubrications, Vibrations and Fluid Dynamics with Mechanical Equipment such as Pumps, Compressors, Agitators, Bearings, Drives, etc. Must be able to apply higher mathematics in solution of mechanical problems. For consultation and evaluation work.

MAINTENANCE ENGINEERS: Five to ten years in planning maintenance work, establishing manpower and material requirements, scheduling and controlling work. Must be thoroughly familiar with Machine and Hand Tools used in Plant Maintenance Work. Must have supervised persons doing maintenance work. Must be graduate. For consultation work.

Give experience, education, age, references, personal history, salary received and salary expected. Please be complete and specific.

ALL INQUIRIES WILL BE CONSIDERED PROMPTLY AND KEPT CONFIDENTIAL.

E. I. du Pont de Nemours & Co. (Inc.)

Engineering Department Personnel

WILMINGTON 98, DELAWARE

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** EQUIPMENT: USED OR RESALE

—RATES—

UNDISPLAYED

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INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.

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An advertising inch is measured ⅛" vertically on one column, 3 columns—30 inches—to a page.

New Ads Received by January 9th at the New York office, 330 W. 42nd St., New York 18, N. Y., will appear in the February Issue subject to limitations of space available.

ENGINEERS

Electrical Mechanical Structural

Openings in Ohio offices offering long term employment with good salary for qualified Group Leaders, Designers and Draftsmen experienced in one or more of the following phases of industrial plant design:

Electrical Power, lighting layouts and electrical controls.

Mechanical Plant layout, process piping, conveyors, heating and ventilation, boiler houses, process equipment layout, refrigeration, plumbing, tanks and vessels, packaging equipment, special machinery and equipment.

Structural Structural steel and reinforced concrete.

Please submit complete resume stating experience, education, salary required and availability date.

THE H. K. FERGUSON COMPANY

Engineers and Builders

The Ferguson Building

1783 East 11th Street, Cleveland 14, Ohio

Designer-Draftsman Wanted

by long established Engineering firm for work in North Carolina office specializing in Public Works Projects including Steam-Electric Power Plants, Water Purification Plants, Sewage Treatment Plants and other Public Works Projects:

(a) **One (1) Architectural Engineer** capable of design, layout and production of working plans and specifications and assuming, in addition, supervision of designing and drafting personnel.

(b) **Two (2) Designer-Draftsmen** for Steam-Electric Power Plant design and preparation of working plans for general and detailed layout including structures, equipment and piping.

(c) **Two (2) as per** (b) except for work on Water and Sewage Treatment Plants.

(d) **Two (2) Draftsmen** capable of rapid preparation of completed working drawings from designs by others. Draftsmanship and lettering must be neat and accurate.

Salary open. Furnish complete experience data, samples of workmanship, recent photograph, references, earliest date could report for work, with reply. Only maturely experienced men wanted.

P-8343, POWER **330 W. 42nd St., New York 18, N. Y.**

EXECUTIVE-ENGINEER

Unusual opportunity for aggressive person to act as general manager of newly-formed subsidiary of well-known pipe fabricator. Subsidiary will erect power and industrial piping. Candidate should: (1) be graduate engineer; (2) age 35-42; (3) have extensive experience in piping; (4) possess balanced background in sales, engineering and management. Base location N. Y. Metropolitan Area. Salary plus possible incentive arrangement. Write giving complete resume of personal facts, education, experience and compensation desired.

P-8482, POWER

330 W. 42nd St., New York 18, N. Y.

WANTED

UTILITIES ENGINEER

Applicants should be over 25 years of age and under 50 years of age. Must be technically qualified and experienced in operation and maintenance for high pressure boiler (900 lb.) operation, electrical generation and distribution, and of associated utilities in a heavy-chemical electrolytic plant in the Southwest, generating approximately 500,000 lbs. per hour of steam and 40,000 kilowatts of electricity. Salary open.

Diamond Alkali Company

P. O. Box 686 **Pasadena, Texas**

POWER PLANT PERSONNEL

An east coast utility now constructing a new high-pressure pulverized fuel generating station will accept applications for employment from qualified persons for the following positions.

CHEMIST

To assume full charge of laboratory. Must be experienced and thoroughly conversant with the analysis of water, fuel and lubricating oils. Must know water softening and conditioning and be able to interpret test results into instructions to operators for correction of unusual conditions.

CONTROL ROOM OPERATORS

Will be required to assist the Chief Operator in directing the operation of, and operating from the centralized control room all equipment such as pulverized fuel boilers, hydrogen-cooled turbine generators, switchboards, condensers, boiler feed pumps and all related auxiliaries.

INSTRUMENT MECHANIC

Previous experience on power plant instrument work essential. Must have a good working knowledge of and be able to service and repair such equipment as automatic combustion controls, flow meters, temperature recorders, gages, pH controllers and boiler meters. Must have a good understanding of electrical circuits as well as mechanical devices.

AUXILIARY EQUIPMENT OPERATORS

Must have previous operating experience and be thoroughly familiar with the correct handling of large power plant auxiliary equipment, such as condensers, vacuum pumps, boiler feed pumps, lubricating oil systems, ash systems, air compressors, water softeners, cooling systems, coal pulverizers and associated equipment.

Job is centrally located near excellent residential community, good working conditions, forty-hour week (paid vacations, insurance, sick pay and retirement plan). All personnel selected for employment will be given complete job training at full pay to familiarize them with this particular installation before assuming their regular duties.

Include complete resume of experience and qualifications in first letter, together with recent photograph. Applications treated confidentially when desired.

P-6897, POWER

330 W. 42nd St., New York 18, N. Y.

STEAM ENGINEERS with electrical experience to train as Inspectors of Boilers and machinery for large Insurance Company. Minimum Requirements: Age 30 years; Education, High School; Experience, 5 years operation and maintenance. Normal starting salary with security, employee benefits, and promotion on merit. Reply stating age, experience, education.

P-7813, Power, 330 W. 42 St., N. Y. 18

Engineers — Executives — Technical Men

Salaried Positions, $4,000 to $30,000

This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.

TOMSETT ASSOCIATES

1205-2 Berger Bldg., Pittsburgh 19, Pa.

ATOMIC POWER

WESTINGHOUSE ELECTRIC CORPORATION

IMMEDIATE OPENINGS

For experienced senior and junior engineers

- Servomechanism designer experienced in gear trains, bearing applications, differentials, etc.
- Mechanical engineer, materials experience in wear, corrosion, etc.
- Application or design engineer experienced on hydraulics (pumps, hydraulic motors, flow, calculations).
- Process control engineer, capable of making system study of hydraulic circuits, valves, etc.
- Engineer, experienced in aircraft hydraulic control, remote indication, etc.
- Mechanical designers of complete systems in the instrument servo range.
- Process control engineer to design complete servosystems involving all auxiliary apparatus and all controls.

For application write

Mgr., TECHNICAL EMPLOYMENT

306 Fourth Ave., Pittsburgh 30, Pa.

LEFAX POCKET SIZE TECHNICAL DATA BOOKS $1. EACH

Printed on loose leaf, six hole, 6¾" x 9¾" bond paper each book contains about 140 pages of technical data, presenting condensed, accurate and essential data for the student, engineer, technical worker and business man.

Architecture	Metals	Relays, Meters
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Builder's Data	Radio	Machine Design
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Air Conditioning	Electricity, AC	Piping Data
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Write for FREE Catalogs (over 2000 listings). See for yourself how helpful **LEFAX** can be to you. Send $1 for each book, or $5 for any six books listed.

LEFAX DEPT. PO 6 PHILADELPHIA 7, PA.

New England Boiler Setting Co.

Specialists on

FIRE BRICK CONSTRUCTION

Industrial Furnaces

Expert Repairing

Stephen S. Donoghue

106 Webster St. Arlington 74, Mass.

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short

TELEPHONE: EASTGATE 7-4778

PIERCE CABLE CO.

2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

Air Compressors Wanted

Horizontal Water Cooled—Any size

also 2 Stage portable unit

L. W. BAUER

North Bergen, N. J.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

MECHANICAL ENGINEER with 10 to 15 years experience in operating and office work for employment in the engineering of power and utility facilities for a large industrial plant in the Gulf Coast area. This is not a temporary construction position. P-8276, Power.

WANTED—MECHANICAL Engineer with experience in design and piping layouts of large steam power plants. State age, technical training, experience, and salary desired. Reply to Chief Design Engineer, Duke Power Company, P.O. Box 2178, Charlotte, N. C.

WANTED—MECHANICAL Draftsman with piping layout experience in connection with large power plants. State age, experience, and salary desired. Reply to Chief Design Enginer, Duke Power Company, P.O. Box 2178, Charlotte, N.C.

EXCELLENT OPPORTUNITY for young experienced engineer to assume complete charge of paper mill engineering and maintenance, including supervision of pulverized fuel power plant located in the mid-west. P-8297, Power.

STEAM PLANT Superintendent—Electric power cooperative with power plant under construction needs engineer with construction and steam plant operating experience to be in charge of operating 15,000 KW unit on pulverized coal fuel. In reply furnish details on experience, qualifications, age, salary expected, education, etc., Box 269, Jefferson City, Missouri.

DRAFTSMAN—centrifugal pumps; should be experienced in drawing multi-stage pumps, etc. Excellent opportunity in southern Ohio for man with sound design sense. Give full details training and experience P-8405, Power.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500 to $35,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G. 241 Orange St., New Haven, Conn.

POSITIONS WANTED

MECHANICAL ENGINEER, 28, BSME, looking for top flight position in consulting engineering or power plant superintendent. Have over 6 years of finest experience, including power plant design and operation, heat engineering, fluid flow, water treating, and related fields. PW-8484, Power.

MECHANICAL ENGINEER — B.M.S. N.Y.S. Maritime Coll. one yr. experience plant operation, maintenance, desires design, development opportunity—salary secondary. N.Y. area preferred. PW-8490, Power.

MECHANICAL ENGINEER — Veteran 39, B.S.M.E., PE, 7 years Gas and NH_3 plant operation, 3½ years plant design. Experience in pumps, piping, gas plant equipment, medium size boiler plants, and control equipment. Desires responsible engineering or operating position in South or Southwest. PW-8869, Power.

STEAM POWER Engineer desires connection with progressive concern. Broad experience and technical supplement in operation and maintenance of modern steam plant equipment. Familiar with water filtration, sewage disposal systems. Proven supervisory ability. Excellent references. Age 30, Married. PW-8293, Power.

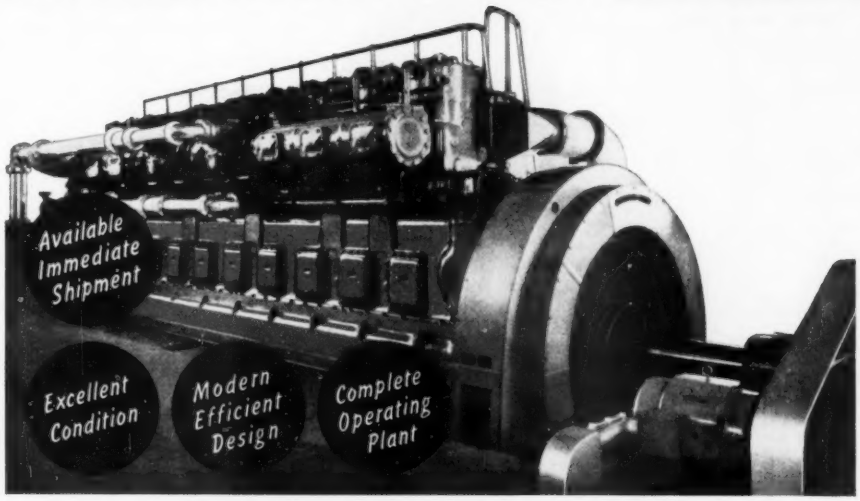
BUSINESS OPPORTUNITY

Wanted to buy.

Power company of about 200 KW of installed capacity. BO-8308, Power.

ADDITIONAL WANTED ADVERTISING ON PAGE 288

POWER PLANT MACHINERY



1675 KVA Fairbanks-Morse Diesel Generator Unit

1675 KVA 50° Fairbanks-Morse alternating current generator 3 phase 60 cycle 2400/600/480 volts 300 RPM direct connected to **1750 HP** Fairbanks-Morse Diesel Engine, 2 cycle, 10 cylinders, Model 33E16, 300 RPM.

The above unit is complete with direct connected exciter, switchgear, starting equipment, heat exchanger, air scavenger, pumps, oil reclaimer, Maxim silencer and inter-connecting piping and fittings as in operation.

STEAM TURBINE GENERATOR UNITS

3 Phase 60 Cycle

6,250 KVA Allis Chalmers condensing, 200 lb. steam pressue, 500° FTT, 2400/4160 volts, with surface condenser.

2,800 KVA General Electric condensing extraction, 400/600 lb. steam pressure, 750° FTT, 100-150 lb. extraction, 480/2400/4160 volts.

1,875 KVA General Electric non-condensing extraction, 400/600 lb. steam pressure, 750° FTT, 100-150 lb. extraction, 0-10 lb. exhaust, 480/2400 volts.

1,250 KVA Westinghouse condensing extraction, 150-250 lb. steam pressure, 600° FTT, 10 lb. extraction, 480 volts, with surface condenser.

625 KVA Westinghouse non-condensing, 150-200 lb. steam pressure, 600° FTT, 25 lb. exhaust, 480 volts.

SPECIAL
NEW 2500 KVA TURBINE GENERATOR UNITS
3 Phase 120/180/240 Cycle

3—2500 KVA General Electric Generators, 3 phase, 120/180/240 cycle, 480/2300/4150 volts, direct connected to General Electric Automatic Extraction Condensing Turbines, 400/600 lb. steam pressure, 100/150 lb. extraction pressure.

UNIFLOW ENGINE GENERATOR UNITS

3 Phase 60 Cycle

750 KVA Allis Chalmers-Ames vertical, 150 lb. steam pressure, 5 lb. exhaust, 2400/4160 volts.

625 KVA General Electric-Skinner horizontal, 150 lb. steam pressure, 5 lb. exhaust, 240 volts.

500 KVA Allis Chalmers-Skinner horizontal, 150 lb. steam pressure, 5 lb. exhaust, 240/480/600 volts.

250 KVA General Electric-Ames vertical, 150 lb. steam pressure, 5 lb. exhaust, 480 volts.

UNIFLOW ENGINE GENERATOR UNIT

125 Volts Direct Current

500 KW Crocker Wheeler-Skinner horizontal, 100-125 lb. steam pressure, 5 lb. exhaust, 125 volts.

DIESEL ENGINE GENERATOR UNITS

3 Phase 60 Cycle

1,675 KVA Fairbanks-Morse, 2400/600/480 volts, 300 RPM.
900 KVA Fairbanks-Morse, 2400 volts, 257 RPM.
625 KVA Busch Sulzer, 2400/600/480 volts, 180 RPM.

Write, Wire or Phone for Further Details and Prices

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 1-9514** **CLEVELAND 14, OHIO**

MOTORS - M.G. SETS - CONTROLS

AT REDUCED PRICES!

NEW SLIP RING

300 HP, 900 RPM, G.E. Type MT-566, 440-3-60, SPBB, complete with magnetic starter, drum and grids.

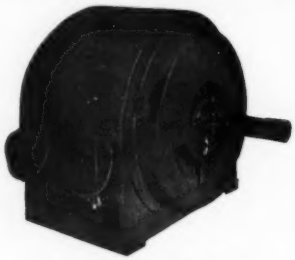
M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
400	125/250	2300	Ideal
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	125/250	2300	G.E.
100	250	220/440	Star (New)
75	250	440	Allis
60	250	220	G.E.
50	250	440	Ideal(New)
30	250	440	Ideal
7½VS	250	220/440	Rel (New)

Reconditioned and guaranteed

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
900	150	440	G.E.	80%
650	138	2300	Whse.	Engine
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
350	200	2300	Whse.	100%
300	720	440	Whse.	80%
250	514	2300	A-C	90%
150	900	2300	G.E.	100%
150	1200	440	G.E.	80%
75	900	220	E-M	80%



SLIP RING — R & G.

HP	RPM	Volts	Mfg.
1500	514	2300	A-C
800	514	2300	Whse.
500	1200	220/440	Elliot (New)
500	450	2300	G.E.
450	514	440	Whse.
400	720	2300	G.E.
350	450	2300	Whse.
300	600	440	G.E.
200	1200	440	G.E.
150	1200	2300	G.E.
50	720	220	Whse.

NEW AIR CIRCUIT BREAKERS

12—New 600 amp., ET-20, 3 pole, 3 trip, ITE Air Circuit Breakers, 600 volts.

NEW DIRECT CURRENT

230 Volt Drip proof — ball bearing

Qu.	HP	RPM	Mfg.	Frame
3	3	690/2660	G.E.	284
10	5	850/1700	G.E.	CD-66
5	7½	575/1750	G.E.	CD-77
1	10	575/2300	L.A.	4051
3	10	1750	Rel.	T-34
5	250	1750	A-C	149

Reconditioned and guaranteed

230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball.
200	400/1200	Rel	Ball.
150	350/1200	Whse.	Ball.
125/150	250/1000	Rel	Sleeve
100	475/1350	E-D	Ped.
75	500/1500	C-W	Sleeve
50	400/1200	G.E.	Sleeve
50	350/1050	Whse.	Ball.
40	400/1600	C-W	Ball.
30	400/1200	Rel (TEFC)	Ball.
30	700/1400	Rel (TEFC)	Ball.
25/30	500/1500	Rel	Ball.
25	690	Rel	Ball.
20	300/1200	Rel	Ball.
15	575/1000	Rel	Ball.
15	700/1350	Rel	Ball.
10	600/1200	Rel (TEFC)	Ball.
10	850	Rel	Ball.
7½	400/1600	Rel	Ball.
7½	600/1800	Rel (TEFC)	Ball.
7½	200/1200	Whse (TEFC)	Ball.
5/7½	400/1600	Whse	Ball.

Buy from BOSWICK with confidence

BOSWICK ELECTRIC CO.

WAlbridge 1195

P.O. BOX 55 AKRON 9, OHIO

MOTORS - M. G. SETS - COMPRESSORS, ETC.

FAST SHIPMENT

MOTOR GENERATOR SETS

3 ph. 60 cy.

KW	MAKE	RPM	D.C. VOLTS	A.C. VOLTS
500	Cr. Wh.	720	250	2300
300	G.E.	1200	250	4000/2300
300	West.	1200	550	4000/2300
240	G.E.	1200	250	4000/2300
200	G.E.	1200	250	4000/2300
150	West.	1200	125	2300/440
150	Ridg.	900	250	2300
100	G.E.	1200	250	2300/440
100	Ridg.	1200	250	2300/440
75	West.	900	75	440/220
35	G.E.	1800	125	440/220

Also Smaller Units In Stock

ROTARY CONVERTERS

KW	MAKE	RPM	D.C. VOLTS	A.C. VOLTS
300	G.E. HC12	600	250	4000/2300
300	G.E. HCC6	1200	250	4000/2300
150	G.E.	1200	250	4000/2300

Other sizes available

AIR COMPRESSORS

1575 CFM, 100#, PRE2 Ing. Rd. direct conn. to 265 HP, 2300 v. syn. motor.
741 CFM, 100#, OCB, Chg. Pn. belted 150 HP motor.
500 CFM, 100#, Allis Rotary direct connected 100 H.P. B.B. Motors.

A.C. MOTORS—3 Ph. 60 Cy.

HP	MAKE	RPM	TYPE
500	G.E.	450	MT412—Sl.Rg.
350	West.	600	CW1106—Sl.Rg.
300	G.E.	450	IM—Sl.Rg.
200	G.E.	1200	MI—Sl.Rg.
160	G.E.	600	IK-16—Sq. Cg.
150	West.	514	CS954—Sq. Cg.
150	G.E.	600	ATI—Syn.
125 (3)	Allis	900	ARY—Sq. Cg.
100 (2)	Allis	720	ARX—Sq. Cg.
100 (5)	West.	1200	CS752C—Sq. Cg.
100 (2)	G.E.	450	IM16—Sl.Rg.
75	West.	900	MS342 Sq. Cg.
75	G.E.	600	ITC501JA
50/12.5	G.E.	900/450	IM 2200 v.
40	G.E.	1200	MT336—Sl.Rg.

Also Smaller Units In Stock

D.C. ADJUSTABLE SPEED MOTORS

250 Volts

HP	MAKE	SPEED	TYPE
375	West.	430/860	Ped.
200	West.	400/800	SK210
150	West.	400/800	SK201
125	West.	450/1000	SK193
60	West.	435/870	SK185
50 (2)	Elec. Dyn.	190/760	

Also Smaller Units In Stock

Send us your inquiries for any POWER EQUIPMENT you may require.

MOORHEAD ELECTRICAL MACHINERY COMPANY

361 Noblestown Road Oakdale, Penna. Pittsburgh District

TRANSFORMERS — FOR SALE

1 Phase 60 Cycle

Rebuilt and Guaranteed

3—1250 KVA—G.E. 13800 2400
3—1000 KVA—G.E. 13800 480
3—1250 KVA—G.E. 6900 480
3—1000 KVA—G.E. 4800 480
6— 500 KVA—West. 2400 240/480
9— 333 KVA—West. 6900 480
9— 333 KVA—West. 4800 480
9— 333 KVA—West. 2400 480
3— 200 KVA—G.E. 2400 480/240
3— 150 KVA—G.E. 2400 480/240
3— 100 KVA—G.E. 2400 480/240
3— 100 KVA — G.E. 6900/11950Y 460/230
3— 75 KVA—West. 4800/2400 460/230
3— 50 KVA—G.E. 4800/2400 460/230/115
3— 37½ KVA — G.E. 4800/2400 460/230/115

We Also Solicit Your Inquiries for Special Transformers Including Furnace Transformers

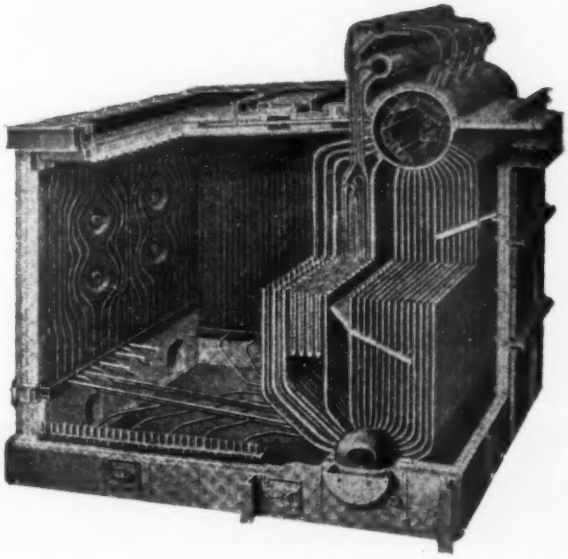
BUFFALO TRANSFORMER CO.
1510 NIAGARA ST.
BUFFALO 13, N. Y.

BOILER SPECIAL

NEW V U TYPE COMBUSTION ENGINEERING CO., WATER TUBE BOILER STATIONARY DESIGN, ASME. CODE, 600# psig., 750° FTT., DELIVERS 140,000# STEAM PER HOUR.

IMMEDIATE DELIVERY

PHOTOS, DRAWINGS on File: Yours for the Asking.



BULLETIN 350 Has Dimension Drawing

Send for It Today Is Free

PRICED FOR QUICK SALE: STORED BALTIMORE, MD.

SAVING OF 45% ON MFRS. TODAY'S PRICE & IMMEDIATE DELIVERY

GENERAL SPECIFICATIONS

Manufacturer	Combustion Engineering Co.
Capacity	140,000# Steam per hour
Fuel	Oil, Gas, Coal (Now built for oil fuel)
Draft Fab-Induction	Buffalo Forge, Model #81½
Forced Draft Fab	Buffalo Forge, Model #8
Air Heat Tubular	Superheater Convection
Heating Surface	7648-sq. ft.
No. Tubes	648-2⅛" x 18 ft.

WE SPECIALIZE IN: Turbo-Generators, own 25 Complete Units Outright, Capacities 300-KVA., to 25,000-KVA. with Condensers and all Auxiliaries. Also Diesel Engines, Generators.

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BREW-WOLTMAN OFFERS

TURBINE UNITS

1—10000 KVA G.E. Cond. 25 cy. 6000 V. 200-lb.
1— 5000 KVA West. Extr. Cond. 60 cy. 480 V. 385-lb.
1— 5000 KVA G. E. Non-C. 60 cy. 13200 V. 600-lb.
1— 2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40-lb. BP
1— 2500 KVA G. E. Extr. Cond. 60 cy. 480 V. 185-200 lb. steel valve chest.
1— 2500 KVA G. E. Cond. 60 cy. 2300 V. 150-lb.
2— 2250 KVA G. E. Cond. 60 cy. 240-400 lb.
1— 1875 KVA Moore Cond. 60 cy. 2300 V. 225-lb.
1— 1563 KVA G. E. Extr. Cond. 60 cy. 480 V. 200-lb.
1— 1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
2— 1250 KVA Elliott Cond. 60 cy. 480 V. 150-200 lb. 600° Surface Condenser
1— 938 KVA G. E. Extr. Cond. 60 cy. 240 V. 200-lb.
1— 625 KVA G. E. Cond. 60 cy. 240 V. 200-lb.
1— 375 KVA G. E. Non-C. 60 cy. 2300 V. 200-lb. 14-lb. BP
2— 250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor

DIESEL ENGINE UNITS

2—1400 HP Fair. Morse 2400 V. 60 cy.
3— 700 HP Gen. Motors 2300 V. 60 cy.
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 600 HP Fair. Morse 2400 V. 60 cy.

STEAM ENGINE UNITS

1—312 KVA Ames Uniflow 240 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—250 KVA Ames Uniflow 480 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—156 KVA Ames Vertical Uniflow 240 V.

ROTARIES—60 CY.

QU.	KW	MFR.	VOLTS-DC	TRANS.	RPM
1	3250	G.E.	225/285	13800	300
1	2000	A.C.	600	4150	514
2	1000	West.	600	4150	720
1	1000	G.E.	600	13200	900 Auto.
3	750	West.	600	11000	1200 Auto.
2	500	West.	250	13200	1200
2	150	West.	250	2200	1200

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. to 485 KW .8 PF 3/60/2300 V. generators.

2—1250 KVA Elliott 3/60/480 V. 3600 RPM generators dir. con. to 150-200 lb. IP 600° TT turbines with dir. con. exciters surface condensers and pumps.

MERCURY ARC RECTIFIERS

QU.	KW	KIND	DC VOLTS	TRANS.
3	4500	Multi Anode	600	13800
2	3250	Ignitron	650	33000
2	1850	Ignitron	360	33000
1	1000	Ignitron	600	13800

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	VOLTS-D.C.	A.C.	RPM
1	1500	West.	250	4000	514
1	1000	G.E.	600	13200	514
1	500	West.	125	2300	720
2	250	C.W.	125/250	220/440	1200
1	200	G.E.	250/275	2300	1200
1	75	Star	240	440	1200
1	75	West.	125	440	1200

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
2	1500	G.E.	2400/4160	900
1	1500	G.E.	4600	900
1	1000	West.	2300	900

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
1	800	Ideal	4160/2400	1200
1	600	G.E.	440	360
2	350	G.E.	2300	257
1	300	G.E.	2300	660
1	300	West.	2300	900

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3125	G.E.	25/60	300
1	3000	G.E.	60/25	300
2	2500	G.E.	25/662/3	750
1	2450	G.E.	662/3/25	750
1	1250	G.E.	25/60	300
1	1250	West.	25/60	300
2	1000	G.E.	25/60	300
1	500	Al. Ch.	25/60	300

TRANSFORMERS—60 CY.

1— 7500 KVA G.E. 138000—41000, 3 ph.
3— 3333 KVA West. 132000—7920/13200 Y
1— 2000 KVA G.E. 88000—13800/23800 3 ph.
3— 1000 KVA West. 66000—2400, 3 ph.
1— 2500 KVA G.E. 59/73 KV, 5 taps, 3 ph.
3— 100 KVA West. 44000—7200/12470 Y
3— 75 KVA G.E. 44000—2300/4600
3— 8333 KVA West. 43800—13900
4— 6667 KVA G.E. 38100/66000Y—12700/22000 Y//13200
1—18750 KVA A.B.B. 34840—11000, 3 ph.
2—15000 KVA Al. Ch. 33000—12500, 3 ph.
2— 7500 KVA Al. Ch. 33000—13800, 3 ph.
1— 1500 KVA G.E. 33000—2300/4600, 3 ph.
3— 667 KVA G.E. 33000—2300/4800
6— 75 KVA Mal. 33000/16500—2300/6900
6— 50 KVA G.E. 33000—2300
2— 4500 KVA G.E. 27000—2300, 3 ph.
3— 3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13280/23000
2— 1000 KVA G.E. 22000/11000—2300, 3 ph.
3— 750 KVA West. 13200—440
3— 333 KVA G.E. 13200—2400/4160
3— 333 KVA West. 13200—440
3— 200 KVA G.E. 11500—220/110
3— 200 KVA Mal. 11000—2300
3— 167 KVA G.E. 7200/12400—240/480
1— 1500 KVA West. 4000—2300, 3 ph. Auto
3— 250 KVA Al. Ch. 2300—460
6— 75 KVA G.E. 480—120/240

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV G.E. FHKO-139 Outdoor
1— 400 A. 37 KV G.E. FHKO-236-500 Outdoor
1—1200 A. 34.5 KV G.E. FKO-338-1000 Outdoor
4— 600 A. 15 KV G.E. FHKO-139-750 Outdoor
2— 600 A. 15 KV West. B-28-B-500 Indoor

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NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

DIESEL GENERATORS

100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine: Lorimer. Model FSSS. 150 H.P. 7½"x9½".
5 cylinder, with electric starting motor.

MOTORS

Westinghouse. 1944. Synchronous—Induction.
60 Pole. 3300 S.H.P. 3 Phase. 82.5 Cycles. 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

BOILERS

WATER TUBE. Babcock & Wilcox. 1945. 2 Drum. Bent Tube. Economisers. Internal Desuperheater. Superheaters. W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

NUMEROUS OTHER ITEMS ARE AVAILABLE

MILNOR & BLEIGH STS. • PHILA. 35, PA.

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MOTOR GENERATOR SETS

1—500 KW G.E. Syn. 250 V. 900 RPM
1—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW G.E. Syn. 600 V. 1200 RPM
1—240 KW G.E. Syn. 250 V. 1200 RPM
2—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW Elliott Syn. 125/250 V. 1200 RPM
1—100 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTERS

1—300 KW G.E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers
1—150 KW G.E. Syn. 250 V. 1200 RPM HCC, 6 Ph. 60 Cy. Transformers

ARMATURES

1—500 KW G.E. 250 V. MPC Gen. 900 RPM
1—300 KW G.E. 600 V. HCC Conv. 1200 RPM

WALLACE E. KIRK COMPANY

502 Grant Bldg., Pittsburgh 19, Pa.

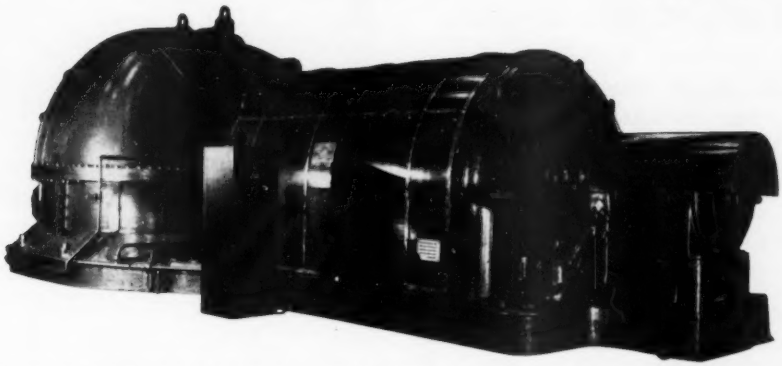
asme — BOILERS — Nat'l B'd.

2—404 H.P. Springfield sectional header
1—250 H.P. Stirling, Class-H. Coxe Stoker
2—400 H.P. built in 1942 (used 3 years) COMPLETE PLANT, forced & induced draft fans, stacks, Spreader stokers & oil burners.

H. P. BREARLEY
34-23 91st STREET JACKSON HEIGHTS, N. Y.

GENERATE YOUR OWN POWER

with "UTILITIES APPROVED" EQUIPMENT



25,000 KVA M—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 200-215 P.S.I.G., 540° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 sq. ft. 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 3-stage, 2300/4000 volts, 200# P.S.I., 600°TT.

3125 KVA G.E. condens., 150#, 550 volts.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, two bearing alternating current generator LESS TURBINE.

2500 KVA G.E. condensing 200 P.S.I. 2400/600/480 volts.

937½ KVA Allis condensing 250 P.S.I., 700° total temperature, 480/600/2400 volts.

937 KVA G.E. bleeder condensing 215 P.S.I.G., 15# extraction, 2300 volts.

625 KVA G.E. non-condensing 150 P.S.I., 20# back, 480 volt.

625 KVA G.E.—Murray condensing 250 P.S.I., 2300 volts.

375 KVA (4) G.E. condensing 400# pressure, 480/600/2300/4150 volts.

125 KVA G.E. non-condensing, 150-200 P.S.I., 2300 volts.

125 KVA Westghse. non-condensing 150/250 P.S.I. 2400 volts NEW

Direct Current

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing

150 KW (2) Westinghouse-Worthington, 250 volts, 3-wire, 225-250 P.S.I. condensing.

100 KW (2) G.E. 125 volt, 200/275 P.S.I. non-condensing

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM 150# P.S.I. non-condensing.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (3) new Westinghouse, 120 volt, 200# P.S.I. condensing.

MOTOR GENERATOR SETS

150 KW G.E., 125 volt direct current generator direct connected 225 HP, 3 phase, 60 cycle, 220 volt, 1200 RPM synch. motor.

100 KVA Westghse. 60 cycle, 2400 volts, 900 RPM alternator direct connected 135 HP, 220 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

1—35 KW and 2—25 KW, 125 volt direct current generators each direct connected to 3 phase, 60 cycle, 2200 volt, 1200 RPM motor.

JANUARY BARGAINS

1—4400 sq. ft. Worthington surface condenser.

4—900 KW, 250/375 volt direct current generators connected 1200 HP, 720 RPM Fairbanks Diesel Engines.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I. non-cond. G.E. turbine.

1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.

1—20 KW, 125 volt Allis direct current generator connected Hill Diesel engine.

9—250 KVA single phase, 60 cycle Westinghouse transformers 11,000/444 volts.

UNAFLOW GENERATOR UNITS

Alternating Current—3 phase, 60 cycle

625 KVA 40°C Rise, General Electric, 240 volts generator connected Skinner non-condensing engine, 150 P.S.I.

625 KVA 240 volt, 150 RPM generator connected Elliott 4-valve, 125 P.S.I.

500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine, 150#.

375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal Engine.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

400 KW G.E. 250 volts, 360 RPM generator connected Skinner vertical engine 150#.

275 KW Westinghouse, 250 volt generator connected Ames vertical engines, 150#.

250 KW (2) G.E., 3-wire, 250 volts generators connected Skinner engines, 150#.

150 KW Westghse. 3-wire, 250 volt generator connected Ball Engine, 150#

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Synchronous (condenser).

900 HP Allis, 2200 volts, 150 RPM.

300 HP G.E., 80% P.F., 2300 volts, 720 RPM.

UMC UTILITIES MACHINERY CORP.

1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422

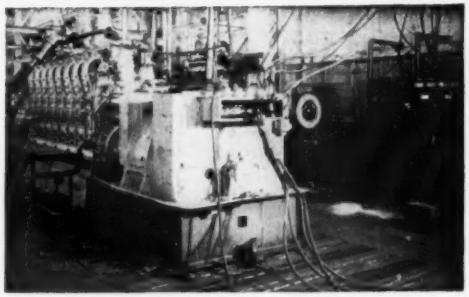
DIESEL POWER

AT 40% TO 60% SAVINGS

EACH ENGINE "REMANUFACTURED"
AND "FULL-LOAD TESTED"
PRIOR TO SHIPMENT

INSPECTION INVITED

ALL EQUIPMENT OFFERED WITH ONE YEAR GUARANTEE



VIEW OF ENGINE TEST STAND FACILITIES AT OUR PLANT IN SAUSALITO (S.F.) CALIF. ALL ENGINE TESTING CONFORMS TO DIESEL MANUFACTURERS' STANDARD METHODS.

A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	237	Ingersoll-Rand	S	255	600
937.5	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

A. G. SCHOONMAKER COMPANY, INC.

52 CHURCH STREET, NEW YORK 7, N. Y.

SHOPS AND WAREHOUSE: JERSEY CITY, N. J. AND SAUSALITO (S.F.) CALIFORNIA

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Check with us when you need new or rebuilt electrical equipment. We have available thousands of motors, generators, motor generator sets, circuit breakers, controls, transformers, frequency changers, etc. Prompt shipment.

- MOTORS
- GENERATORS
- M.G. SETS
- V-S DRIVES
- CONTROLS

GUARANTEED REBUILT

Write for Stock List No. 1622

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

Established 1900

DIESEL ELECTRIC POWER

1—1000 KW C-W (NEW), 4000/2300 Volts, 3/60, 720 RPM, w/F.M. Mod. 38D8-1/8.
3—750 KW, G.E. (NEW) 2400/480 volts, 3/60, 720 RPM, w/G.M. Mod. 12-567A
1—300 KW, Westgh. (NEW), 480 volts, 3/60 720 RPM, w/G.M. Mod. 8-268A.
1—610 KW, G.E., 500 V, D.C. 750 RPM, w/Cooper Bessemer, 950 HP, Mod. GSB-8.
3—300 KW, Westgh., 120/240 V, D.C., 3 wire, 400 RPM, w/Baldwin Mod. V.O.

Sundfelt Equipment Company, Inc.
220 Hudson Street Seattle 8, Wash.

MOTOR GENERATOR SETS

150 K.W. 250 Volt D.C. Gen. Elec. 3 Brg.; 440 Volt 3 Phase 60 Cycle 1200 R.P.M. Synchronous Motor
125 K.W. 250 Volt D.C. Burke 440 Volt 3 Phase 60 Cycle 900 R.P.M. Synchronous Motor
100 K.W. 250 Volt D.C. Gen. Elec. 3 Brg. 440 Volt 3 Phase 60 Cycle 900 R.P.M. Synchronous Motor
50 K.W. 250 Volt D.C. Westing. 4 Brg. 220/-440 Volt 3 Phase 60 Cycle 1200 R.P.M. Motor
20 K.W. 125 Volt D.C. Allis Chalmers 3 Brg. 440 Volt 3 Phase 60 Cycle 1800 R.P.M. Motor

MOTOR REPAIR & MFG. CO.
1557 Hamilton Ave., Cleveland, Ohio

LIQUIDATION SALE — Modern Equipment

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE
1800	General Motors	16-258S	900	4
1800	General Motors	16-278A	720	2
1600	Fairbanks Morse	38D O/P	720	2
1600	Hamilton	RB98-D.A.	700	2
900	General Motors	12-567 ATL	750	2
900	General Motors	6051 (quads)	650	2
500	Superior	6-cyl.	514	4
215	Superior	VDM B	600	4

DIESEL GENERATOR SETS

DC	1200 KW	525V	750 RPM	General Motors	16-278A	
	650 KW	240V	750 RPM	General Motors	12-567	
	125 KW	120/240	600 RPM	Superior	VDMB	
	100 KW	120/240	1200 RPM	General Motors	3-268A	
	60 KW	120V	1200 RPM	Buda	909	
AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	rebuilt

3—150 KW 3/60460 600 RPM Buckeye model 80 diesel
6—100 KW 3/60/460 600 RPM Worthington BB5 diesel
With Westinghouse generators, exciters, cooling systems, starting equipment, switchboard, silencers, etc. Units practically new.

TURBO-GENERATORS—D.C.

1—375 KW 180/240 V GE Shunt. 1200 noncond.
5—300 KW 120 V Whse. Compd. 1200 cond.
1—300 KW 240 V GE Compd. 1200 cond.
12—150 KW 120 V Whse. Shunt. 1200 cond.
12— 60 KW 120 V Whse. Stab. Sh. 1800 cond.
1— 25 KW 125 V 3600

MOTORS—DC

1500 HP 525 V DC 600 RPM W'hse.
1362 HP 415 V DC 1200 RPM Elliott
667 HP 375 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 HP W'hse
50 HP 230 V DC 525/1800 W'hse.
15 HP 120 V DC 500 RPM Diehl

GENERATORS—DC

1200 KW 525 V 750 RPM All. Chalm.
1075 KW 375 V 750 RPM Elliott
700 KW 240 V 500/720 Elliott
375 KW 240 V 1200 W'hse.

AIR COMPRESSOR

2000 CFM at 90 psi, 3 stages, driven by 450 HP diesel mfr. Clark Bros.

NEW PUSHBUTTON STARTERS

2000—Line Starters, magnetic, for AC motors, rated 7½ HP at 440V, 5 HP at 230V, 3 HP at 110V, mfd. by Ward Leonard and Westinghouse.
80—Line Starters, 115V DC, 9.5 amps, G.E. (NEW).

HIGH PRESSURE AIR COMPRESSORS
CENTRIFUGES
EVAPORATORS
TRANSFORMERS
SOOT BLOWERS
WINCH TYPE MOTORS

MODERN TURBO GENERATORS AC

1—2000 KW 3 phase 60 cycle 3600 RPM 480/600/2400/4160V type ATB-2 Form HL driven by steam turbine, 410# steam pressure, exhaust 2½" Hg abs., 275 deg. F superheat. General Electric Company. (also 2900 at 1700 V)
2—250 KW G.E. type ATI 3/60/450 1200 RPM condensing.
2—200 KW Westinghse. 3/60/450 1200 RPM condensing (unused).
6—200 KW G.E. type ATB 3/60/450 1200 RPM cond. and non-cond.

GENERATORS—AC

3—2000 KW 3/60/480/600/2400/4160 3600 RPM type ATB-2 Form HL. Mfd. by G.E.

MOTORS—AC

4—6000 HP at 93-1/3 cycle 400 RPM or 3800 HP at 60 cycle 257 RPM—G.E.

ICE PLANTS (New)

2—22 ton capacity, Freon 12, mfd. by Frick.

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr 35# press.
2—Cyclotherm 3000 pounds steam per hour, 125# press.
1—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435#.
2—Type "D", water tube, Foster Wheeler, 15000# steam/hr., 275# press.

STEAM TURBINES

All New

1—110 HP 250# steam, 10# each. 1200 RPM Sturtevant
10—56.5 HP, 300-475# steam, 10-15# each. 1225-1600 RPM, Sturtevant

CONDENSERS

(Most are new)

No.	Sq. Ft.	Make	Passes	Tubes	
2	8000	C.H.Wheeler	2	Brass	⅝"
4	3300	Str. Wells	2	Alu-Brass	⅝"
4	1050	Conseco	2	Cu Ni	⅝"
30	400	All. Chalm.	2	Brass	⅝"
4	300	Wheeler	2	Cu Ni	⅝"
8	155	Conseco	2	Brass	¾"

AIR EJECTORS

1—Foster Wheeler for 3800 sq. ft. cond.
5—Westinghouse type C-42, for 9300 sq. ft. condenser.
2—Ingersoll Rand 275# press., for 8250 sq. ft. condenser.
2—C. H. Wheeler, type 4H240, for 8000 sq. ft. condenser.

HYDRAULIC PUMPS

Vertical quintuplex pumps, 450 GPM, 1750 psi, 128 RPM, mfr. Aldrich, with 700 HP 3/60/2300 motors.

AXIAL FLOW FANS

16,000 CFM 3" S.P. 3/60/440 Buffalo
12,000 CFM 3" S.P. 3/60/440 Clarage
35,000 CFM 1" S.P. 230V DC Wing

BLOWERS — AIR PUMP

5—Blowers, Roots Connersville, size 16x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum.
1—Air Pump, Ingersoll Rand, type FS548, 5500 CFM, discharge press. 24.22 abs., intake press. 20.61 abs., with 125 HP motor 3/60/2300.
1—Air Pump, Ingersoll Rand, type FS548, 6480 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2300.
1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.

WIRE ROPE SLINGS

Dia. from ⅝" to 2½"
Length from 10 ft. to 150 ft.

HOISTS

15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

HEAT TREATING FURNACES

BOILER FEED PUMPS
FIRE, IRRIGATION AND GENERAL SERVICE PUMPS
OXYGEN PRODUCING PLANTS
WELDING ELECTRODES
REDUCTION GEARS

HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.
Tel. REctor 2-1334

220/440 Volt, 60 cycle **SQUIRREL CAGE** open, 3 Phase

GUARANTEED REBUILT

QN.	HP	MAKE	TYPE	BEARING	SPEED
1	200	G.E.	IK	S.B.	900
1	200	G.E.	IK	S.B.	720
1	150	G.E.	IK	S.B.	600
1	150	G.E.	IK	S.B.	720
1	150	G.E.	IK	S.B.	1800
2	125	Kiliq		B.B.*	1800
1	100	West.	MS	S.B.	1200
1	100	West.	CS	S.B.	720
2	100	G.E.	IK	S.B.	720
1	100	G.E.	KT-347	S.B.	1200
2	100	G.E.	IK	S.B.	900
1	100	G.E.	IK	S.B.	1800†
3	100	G.E.	IK	S.B.	1800
1	100	West.	CS-504	S.B.	1800
1	75	G.E.	IK	S.B.	600
2	75	G.E.	IK	S.B.	720
2	75	West.	CS-752C	S.B.	900
1	75	G.E.	K-505	S.B.	1200
1	75	G.E.	IK	S.B.	1800†
2	75	G.E.	IK	S.B.	900
4	75	West.	CS	S.B.	1200
4	75	G.E.	IK	S.B.	1200
2	75	F.M.	QS-445	B.B.	1800

QN.	HP	MAKE	TYPE	BEARING	SPEED
2	75	G.E.	IK	S.B.	1800
1	60	G.E.	KT-348	S.B.	900
1	60	G.E.	IK	S.B.	1200
1	60	F.M.	QS-444	B.B.	1800
1	60	G.E.	KT-333	S.B.	1800
4	60	G.E.	IK	S.B.	1800
1	50	G.E.	IK	S.B.	600
3	50	West.	CS	S.B.	900
1	50	G.E.	KT-342	S.B.	900
1	50	G.E.	KT-342	S.B.	900†
2	50	West.	CS-445	S.B.	1200
1	50	G.E.	KT-327	S.B.	1800
2	50	G.E.	IK	S.B.	1800†
3	50	G.E.	IK	S.B.	1800
1	40	G.E.	KT-342	S.B.	720
1	40	F.M.	BH12D	S.B.	900
1	40	G.E.	KT-336	S.B.	900
1	40	West.	CS	S.B.	1200
2	40	G.E.	IK	S.B.	1800†
2	40	G.E.	IK	S.B.	1800
1	35	G.E.	IK	S.B.	720
1	35	Triumph	B12	S.B.	900
3	30	G.E.	KT-312	S.B.	1800

QN.	HP	MAKE	TYPE	BEARING	SPEED
3	30	G.E.	IK	S.B.	1800
5	30	West.	K-385	S.B.*	3600
1	25	G.E.	IK	S.B.	720
1	25	F.M.	B12P	B.B.	720
1	25	Century	56-30	S.B.	1200
1	25	F.M.	BH12A	S.B.	1200
1	25	Ideal	A 15	S.B.	1200
1	25	West.	CS-471	S.B.	1800
1	20	F.M.	KBV	B.B.	1200
1	20	G.E.	KT-322	S.B.	1200
1	20	G.E.	KT-312	S.B.	1200
1	20	G.E.	K-364	S.B.	1800
1	20	West.	CS-364	S.B.	1800
2	20	G.E.	K-328	B.B.	3600
4	20	Line-Weld	Frame 328	B.B.	3600
2	15	West.	CS	S.B.	720
1	15	Wagner	15 T	S.B.	1200
1	15	Ideal	A	S.B.	1200
1	15	G.E.	KT-502	S.B.	1200
1	15	G.E.	KT-752	S.B.	1800
1	10	G.E.	IK	S.B.	1200
1	10	G.E.	KT-752	S.B.	1200

* Splash proof † 2200 volt

SLIP RING MOTORS

We offer from stock the following 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT equipment, unless otherwise noted.

QUAN.	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
1	15	G.E.	MT 512	900	S.B.
1	30	G.E.	MT 332	900	
1	30	Al. Ch.	ANY	600	
2	40	Al. Ch.	ARY 444	1800	splash proof, B.B.
1	40	G.E.	MT 336	900	S.B.
1	50	G.E.	I-M	900	S.B.
2	60	G.E.	MT 556	600	
1	60	G.E.	MT 546	900	
1	60	G.E.	I-M	900	
1	60	West.	CW 505	1200	
1	75	G.E.	I-M	720	
1	100	G.E.	I-M	720	
1	100	G.E.	I-M	900	
1	125	G.E.	I-M	720	
1	150	G.E.	I-M	900	
1	150	G.E.	I-M	1800	2300 volt
1	200	G.E.	I-M	900	

TOTALLY ENCLOSED MOTORS

FAN COOLED, BALL BEARING, 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT, unless otherwise noted.

QUAN.	H.P.	MAKE	TYPE	SPEED	DESCRIPTION
1	7½	G.E.	KF 284	1800	
1	7½	Reliance	AA 324	1200	XP, NEW
3	10	L.A.	JS 328	1200	
1	15	West.	CS 328	1800	XP, NEW
1	25	L.A.	JS 364	1800	
1	40	G.E.	K 405	1800	XP, NEW
1	50	Master	FB 404	3600	XP, NEW
1	50	Al. Ch.	ARZZ 444	1800	NEW
1	75	G.E.	K 505	1200	

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Telephone: Genesee 5629

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6—100 KW Worthington Diesel Engines

Model BB-5, 600 RPM connected to 125 KVA, Generators, 3/60/460 equipped with Evaporative Cooler, Switchboard, Silencers and Fuel Tanks. These units were never used commercially—run for test purposes only.

60 KW G. M. 671-RC. 1200 RPM 3/60/220/440

300 KW, G. M., Model 8-268A, 3/60/240, 1200 RPM (2) NEW

290 KW, G.M., Model 8-268A, 1200 RPM, 120/240 D.C.

(2) REBUILT AND GUARANTEED

We have a large inventory of NEW and REBUILT Explosion Proof and TEFC Motors in stock for IMMEDIATE SHIPMENT.

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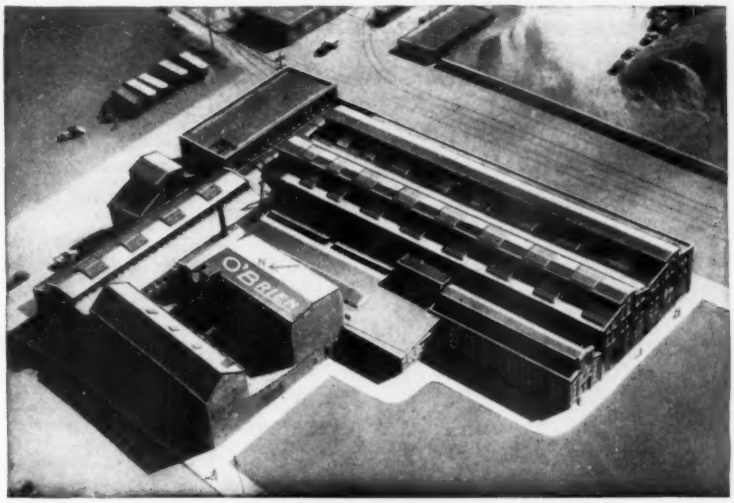

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1547 N. DELAWARE AVE., PHILADELPHIA, PA.
PRR Siding—35 ton OET Crane Capacity

ELECTRIC MOTORS

3 PHASE — 60 CYCLE

Q.	HP	Make	Type	Volts	Speed
1	1200	Cr. Wh.	Sl. Rg.	2300	257
1	1000	West.	CW	2300	450
1	650	G.E.	TS(Syn)	440	360
2	600	West.	Syn.	440	257
1	600	G.E.	IM	440/2300	600
1	400	West.	CW	440	514
1	350	West.	CW	440	600
1	350	G.E.	Syn.	440	900
1	315	G.E.	Syn.	2200	720
1	250	C.W.	C.W.	440	514
1	250	G.E.	K-TEFC	2200	514
1	250	West.	CS	2200 (25 cyc)	375
1	250	West.	CS	2300	1200
2	200	E.M.	Syn.	4160	600
1	200	West.	MW	440	600
1	150	Al. Ch.	SC	220	1800
1	150	Ideal	Syn.	220	1200
1	150	El. Mch.	Syn.	220	900
1	150	G.E.	KT-558	440	900
1	125	Cent.	SC	440	1800
2	100	West.	CS	220	1800
1	100	Cent.	SC	220	1200
2	75	Cent.	SC	440	1200
1	75	West.	CW	440	1200
1	60	Ideal	SC	220	1200
1	60	West.	CW	440	600
1	60	West.	C.W.	440	720
1	50	West.	C.W.	220	900
1	50	G.E.	I.M.	440	600
2	50	Cent.	SC	220	1200
1	40	G.E.	MT-536	440	900
1	30	G.E.	MT-532	440	900
2	25	G.E.	MT-332	440	900
1	100	West.	SK183	230V. D.C.	400/1200
1	50	Cr. Wh.	CMC	230V. D.C.	300/1200

MOTOR GENERATOR SETS

1—1000KW GE MPC ATI 550v. 3/60/2300
1— 500KW GE MPC ATI 250v. 3/60/2300/720
1— 750 KW G.E. 250 v. 3/60/2300 volt
1— 200KW West. 250v. 3/60/2300 volt, 1200 rpm
1— 200KW West. 250v. 3/60/220-440/1200 rpm
1—100KW G.E. 125 3/60/220/1200 rpm Syn
1—80KW G.E., 240 v. 3/60/440/1800 rpm
1— 50KW G.E. 250 volt, 3/60/240/1200 rpm
1— 50KW G.E. 125 volt, 3/60/220/1200 rpm
1— 40KW Ideal, 125 volt, 3/60/220/1200 rpm
1—40KW West. 240 v. 3/60/220-440/1200 rpm synchronous
3—7½KW G.E., 60v. 3/60/220-440 volt

AIR COMPRESSORS

3—12,000 CFM Ingersoll Rand Turbo Compressors 3.25# pressure, 250 HP 3/60/440/3600 rpm motor drive.
1—3000CFM Sullivan Angle Compound 100 psi, 600 HP Syn. M.D. 3/60/2300
1—1050CFM Worthington, 18x11x14 100 psi, 257 RPM, Belted
1—1050CFM Ingersoll-Rand ES-1, 17¾x18, 50 psi, 275 RPM, V-belt
1—734CFM Sullivan Angle Class W13, Single Stage 18x18x8, 60 Lb., 300 RPM, v-belt, 100 HP
2—525 CFM Chicago NSB, 100 Lb., 285 RPM, V-belt, 14x12
2—368CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D., 3/60/220
1—229CFM NEW Chicago PB 4 Air Cooled, 870 RPM, 125 Lb., V-belted, 50 HP, M.D.
1—245CFM IR-10x10 ER-1, 125 Lb.
1—215CFM Penna. 3A—10x8, 50 Lb.
1—211CFM NEW Chicago 9x8 T-B Horizontal 100 psi, V-belt
2—173CFM Ingersoll ER-1, 9x8, 300 RPM, 100 Lb., V-belt
3—120 CFM I-R—8x6 ER-1, 55 Lb.
1—92CFM I-R—7x6, ER-1, 100 Lb.
1—67CFM Chicago NSB—6x6—150 Lb.

DIESEL GENERATORS

1—2500KVA General Motors, complete plant, 3/60/2300 with 2300 to 230/460 transformers, cooling system, starting equipment, switchboard, can demonstrate on foundations. Immediately available.
1—1000KVA Hamilton Model 99DA, 3/60/2300/600 rpm complete portable or stationary—never used.
200KW Fairbanks Morse, 250 v., D.C. 720 rpm 8 cylinder, 4 cycle, Complete—1940
200KW G.E.-Fairbanks Morse, 720 rpm, 3/60/220/440—8 cyl., 4 cycle—1940
156KVA Cummins LI 400 3/60/440/900 rpm—Radiator—Sw. Bd.
113KVA Waukesha Port 3/60/440, 1200 rpm 1944
100KVA Cooper Bessemer 8 cy 900 rpm, 3/60/220
56KVA G.E.-Climax Gasoline Portable, 3/60/220/1200 rpm
40KVA NEW Chrysler 3/60/220—2 units
30KW Buda, 3/60/220/1200 rpm
20KW Le Roi Gasoline—1/60/110-220 volt

TURBO-GENERATORS Non-Condensing

1—625KW West. 3/60/2300/3600 RPM, 125 Lb. psi, 6 Lb. B.P.
1—400KW West. 3/60/480, 150 psi., 10 Lb. B.P.
1—300KW Elliott (New 1941) 250 Volt D.C., 150 Lb. I.S.P., 20 Lb. B.P.
1—300KW G.E. 3/60/2300/100 p.s.i. 0-15 Lb. B.P.
1—300KW G.E. 3/60/2300/3600 RPM, 175 psi, 6 Lb. B.P.
1—160KW West. 3/60/220/3600 RPM, 125 Lb. psi., 10 Lb. B.P.
1—160KW Ridgeway 4 Valve Steam Engine Generator, 3/60/220
1—150KW NEW West. 250 Volt D.C. 225 Psi., 25 B.P.
1—100KW NEW 3/60/220 150/200 psi. 0/30 Lb. B.P.
1—600KW G.E. Extraction 360/2300/250 psi., 80 lb. & 16 lb. extraction. Surface Condenser new 1940.
1—35KW G.E. 125 volt D.C., 3600 RPM

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Centrifugal and reciprocating pumps, large stocks—1" to 20". Advise requirements.

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HERE'S A PARTIAL LISTING OF OUR GIANT STOCK OF "REBUILTS"

SQUIRREL CAGE MOTORS

3 Phase, 60 cycle—220 or 440 volt
*(2200 volt or higher)

HP	Make	Type	Speed
750	*G.E.	KT	720
700	*G.E.	IK	600
600	*Westg.	OS	1200
500	*G.E.	IK	450
500	G.E.	IK	450
400	*G.E. (ExPf.)	K	3600
400	*G.E.	IK	1800
400	*Cont. (BpPf)	K	1200
400	*Al.Ch. (BpPf)	ANW	600
400	*Westg (Vert.)	CS	720
400	G.E.	IK	514
400	*G.E.	KT	450
350	*G.E.	IK	3600
350	Al.Ch. (New)	ARW628	3600
350	*Cr. Wh.	S	600
325	G.E.	KT	385
300	*Westg.	CS	3600
300	G.E.	FT558	1800
300	G.E.	KF558	1800
300	*G.E. (25cyc.)	IK	750
300	*G.E.	IK	514
250	Al.Ch. (TEFC)	ARWW	3600
250	G.E.	FT549	3600
250	*L.A.	DGS	1200
250	Al.Ch. (New)	ARW638	900
250	Westg.	CS856A	600
250	G.E.	IK	514
200	*Al.Ch. (New)	ARW823	3600
200	Wagner	RP	1800
200	G.E.	KTP	1200
200	*G.E.	IK	1200
200	G.E.	IK	900
200	Westg.	CS	720
200	*Al.Ch.	AN	720
200	F.M.	H	450
150	G.E.	FT	3600
150	G.E.	IK	1750
150	Westg.	CS	1750
150	G.E.	IK	1200
150	Al.Ch. (New)	AZ	1200
150	*G.E.	IK	1200
150	Westg.	CS850A	900
150	G.E.	IK	900
150	G.E.	IK	720
150	G.E.	IK	600
150	G.E.	IK	450

SLIP RING MOTORS

3 phase 60 cycle—220 or 440 volt
*(2200 V or higher)

HP	Make	Type	Speed
2500	*Westg.	CW-MIII	720
2500	*G.E.	MT	257
2000	*G.E.	MT30	240
1200	*G.E.	MT26	277
1000	*Westg.	CW-MIII	720
800	*Westg.	CW-MIII	720
700	*Westg.	CW	720
650	Westg.	HE	360
500	*G.E.	IM	600
500	Westg.	CW	360
450	G.E.	IM	514
400	G.E.	IM	600
400	*Westg.	CW	480
350	*Westg.	SW	600
350	Al. Ch.	ANY	600
300	*G.E.	IM	1800
300	Al. Ch.	ANY	720
300	Al. Ch.	ANY	600
300	*G.E.	IM	450
250	Westg.	CW	1800
250	G.E.	IM	1200
250	Westg.	CW32B	900
250	Al. Ch. (New)	ARY	720
250	Al. Ch.	ANY	600
250	G.E.	IM	450
200	Westg.	CW	1800
200	Al. Ch. (New)	ARY	1200
200	Westg.	CW	900
200	Al. Ch.	ANY	600
200	*G.E.	IM	600
200	G.E.	IM	600
150	G.E.	IM	1750
150	Westg.	CW772	1200
150	*Westg.	CW	1200
150	Westg.	CW870C	900
150	Westg.	CW	720
150	G.E.	IM	720
150	*Westg.	CW868A	600
150	Al. Ch.	ANY	600
150	G.E.	IM	514
125	*Westg.	CW	1200
125	G.E.	IM	1200
125	G.E. (New)	M6333	900

D.C. MOTORS 230 Volts

H.P.	Make	Type	Speed
800	Westg 600V	CD-1604	375
350	G.E.	CMC-101	375
250	Cr. Wh.	CMC-101	1200
222	Westg.	SK-153	2975
200	G.E.	CVC	925
200	Reliance	1970T	675
150	Westg.	SK-154L	1750
150	Westg.	SK-183	1100
150	Cr. Wh. BB	93-H	1200
150	G.E.	IC	900
125	G.E.	RC-15	1750
100	G.E.	RC-34	2500
100	G.E.	RC-58	850
80	Cr. Wh.	CCM	450
75	Fair.-Mor. (New)	CP	1750
75	Reliance	T	1750
75	Cr. Wh. BB	CMC	1150
60	Westg.	SK-133	1200
60	G.E. 550V	CD	1000
40	Al. Ch.	E-131	850
40	G.E.	RC-34	750
30	G.E.	RC-35	790
30	G.E.	CD-2904	600
35	Roth	FR-40S	850

MOTOR GENERATOR SETS

KW	Make	A.C.	D.C.
1000	G.E.	4600	275
500	G.E.	2300	230
500	G.E.	4000	1200
300	Westg.	2300	250
450	G.E.	2300	250
200	Cr. Wh.	2300	125
200	G.E.	440	250
150	G.E.	440	250
150	Al. Ch.	220	125
100	G.E.	440	250
75	Star	440	250
75	G.E.	440	250
60	Al. Ch.	2300	110
50	Westg.	220	110
40	Cr. Wh.	440	250
40	Al. Ch.	220	125
25	G.E.	440	250
20	Cr. Wh.	220	125
20	G.E.	440	250

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4—Allis Chalmers Electrifugal, Size 6" x 5" SSL 20 H.P., 220 or 440 volt, 3/60—1800 RPM, Splash proof. Cap. 1000 GPM, 68' head.

2—Fairbanks-Morse, Size 3"—5532 with 15 H.P. 220/440/3/60—1800 RPM, Splash proof motors. Cap. 300 GPM, 100' head.

2—Vacuum, Size O Nash Hytor, 50 CFM, 15" hg.

2—Beach-Russ, Size 5, Vacuum, 60 CFM, 26" hg.

MOTORS

1—50 H.P. G.E. Slip Ring 220/3/60—900 RPM with drum and grids.

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Outstanding Offers

2—10000 KW Cond. Turbo-Generators

2—1000 KW & 500 KW Non-Cond Turbines, 200#

500 KW & 300 KW Cond. Turbo-Gen., 250#

1—575 KW Diesel Set, 360 r.p.m. (never used)

3—1667 KVA Transformers, 12000-2300V.

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40,000 lbs. Int. Furnace 400# (equal new)

480 HP Sectional Header 250#, 100° S.H. (A-1)

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SPECIAL OFFERINGS

TURBO-GENERATORS

1—5000 KW, 13,200 V, 200# Cd.

2—4000 KW, 13,800 V, 600# NEW N.C.

2—4000 KW, 4150 V, 600# NEW Cd.

2—4000 KW, 2300 V, 200# Cond.

1—3500 KW, 2300 V, 150# Cond.

1—3000 KW, 2300 V, 150# Cond.

1—2500 KW, 480 V, 150# Cond.

1—2500 KW, 550 V, 250# Cond.

2—1800 KW, 2300 V, 400# Cond.

1—1000 KW, 2300 V, 200# N.C.

1—1000 KW, 2500 V, 185# Cond.

2—1000 KW, 480 V, 180# Cond.

1—750 KW, 2300 V, 175# Extr.

1—750 KW, 550 V, 170# Extr.

1—750 KW, 240 V, 150# Cond.

1—500 KW, 2300 V, 175# Extr.

1—150 KW, 2400 V, 130# Extr.

1—150 KW, 2400 V, 130# N.C.

1—20,000 KW, 25 cycle

ENGINE GENERATORS

1—500 KW, 2300 V, Unit.

1—335 KW, 2300 V, Unit.

1—188 KW, 220 V, Unit.

BOILERS

2—50,000#, 300#

1—30,000#, 425#

1—35,000#, 150#

3— 750 HP, 200#

1— 550 HP, 220#

2— 500 HP, 200#

3— 500 HP, 400#

1— 438 HP, 200#

2— 400 HP, 150#

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1—100,000# pr. hr.

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1 to 50 HP
NEW and REBUILT
TEFC—EX. PR.—Drip proof and Splash proof
IN STOCK

SQUIRREL CAGE MOTORS
3 phase

H.P.	Make	Type	Speed
450	G.E.(vert.)	KF-6338	1180
250	L-A.	137S	1150
200	G.E.	KT557	1760
200	G.E.	KF-6335	580
150	West.	CS	580
125	G.E.	IK	870
100	Wagner (NEW)	XP	1150
100	G.E.	K-544	1175
100	West.	CS	870
100	Al.Ch.		580
75	West. (2)	CS-654C	1750
75	Cont.	B.B.	1750
75	G.E. (3)	K-505	1175
75	G.E.	IK	900
75	G.E. (3)	KT-352	865
75	West.	CS	720
75	G.E.	KT 558	580
60	F-M	XP	1750
60	Howell	SCR	1800
60	Century		1150
60	West. (2)	CS-607	880
60	Rel. (2)	AA	875
60	G.E.	KT-346	865
60	G.E.	TEFC(GH)	427
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	West.	CS	1740
50	L. A.	XP	1150
50	West.	XP	1150
50	G.E.	KF-445	1170
50	West.	CS-642C	1160
50	West. (3)	CS	870
50	G.E. (2)	IK	870
50	G.E.	FTR-542	870
50	West.	CS	690
40	G.E.	TEFC(GH)	561

SLIPRING MOTORS
3 phase

H.P.	Make	Type	Speed
600	Cr.Wh.	131AQ	507
500	G.E. (2)	IM	450
400	West.	CW1218	500
225	Wagner	25 cy.	710
200	G.E.	MTP-557	1800
200	G.E. (2)	IM	1170
150	Wagner	31VRN	900
100	Al.Ch.		690
75	West.	CW	1150
75	West.	CW	720
75	G.E.	MT556	720
75	G.E.	IM	690
60	West.	HF	850
60	Al.Ch.		690
50	G.E.	MT-536	1160
50	West.	CW	1150
50	L. A.	OGH	870
50	F-M	BV	600
50	Al.Ch.	ARY	575
50	G.E.	IM	490

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
475	West.		720
300	G.E.	ATI	900
260	G.E.	TS	900
250	Ideal	SMN	360
200	Ideal	SMW	257
180	G.E.	ATI	900
150	G.E. (2)	TS	1200
150	G.E.	ATI	900
125	G.E.	ATI	900
135	West.	G	1200
135	Ideal		1200
100	Elec.Prods.		1200
55	El.Machry.	BRKT	1200

550 V.D.C. MOTORS

H.P.	Make	Type	Speed
765	G.E. (4)	MPC	1045/1350

230 V.D.C. MOTORS

H.P.	Make	Type	Speed
400	A-C		415
150	G.E.	MPC	400
125	G.E.	RC-15	1750
100	Al.Ch.		1150
90/45	G.E.	RF-17	950/475
75	Sprague		1000/1500
75	G.E.	RC36	800
75	West. (2)	SK-180	475
75	Cr.Wh.	LT	480/670
75	Cr.Wh.	CMC	375/950
75	E-D	25S	450/1350
75	West. (3)	SK151	250/1000
60	West. (3)	SK-160	680
50	G.E.	RC-12	1750
45/90	G.E.	RF-17	475/1950
50	West. (3)	SK-160	565
50	G.E.	RF-17	250/1000
50	West.	SK	250/1000
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC-31	1700
40	G.E.	RC-32	1100
40	G.E.	RC-34	750
40	G.E. (2)	CD-1441	400/1500
40	Cr.Wh.	CCM	700
40	Rel.	461T	400/1200
35	West.	SK	250/1000
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	G.E. (8)	CDM-85	2200
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West. (2)	SK-143	575
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	G.E.	*CDM-77	1750
25	E.D.	10S	1500
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	300/1200

115 V.D.C. MOTORS

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr.Wh.	CMC	900
40	G.E.	CD-113	850
30	West.	S	600
25	G.E. (2)	CD	1800
25	West.	SK-103	1150
25	Cr.Wh.	CCM	750
25	West.	SA	600/1200
15	E.D.	7½S	650/1230
15	Cr.Wh.	CM	650
10	Century	DN-334	1750
10	G.E. (2)	RC	1200
10	Al.Ch.		900
10	E.D.	7½S	425/1700

AC GENERATORS

KW	Make	Type	Speed
180	G.E.	ATB	900
100	G.E.	ATB	360
75	G.E. (2)	ATB	1200
50	F-M	GG	1200
15	G.E.	ASI	1200

AC GENERATORS
Driven by DC Motors

KVA	Make	D. C. Input	A. C. Output
62½	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	El. Machry.	230	440
18	G.E. (3)	230	120/240
10	Burke	115	120
7½	Hertner	115	440
6¼	G.E.	230	240
5	El.Spec.	115	110
1¼	Al. Ch.	230	110

600 V.D.C. GENERATORS

KW	Make	Speed
400	G. E. (4)	1200
325	G. E.	1200
100	West. SK	900
60	G. E.	1200
30	Burke	1750
20	Reliance	1150

600 V.D.C. BALANCER

200 KW, G.E., MPC, 1200 RPM

GENERATORS
250 V.D.C. Motor Driven

KW	Make	Speed
1000	G. E.	900
500	West.	1200
300	Elliott	1200
300	G. E. (3)	720
200	G. E.	1200
150	West.	900
100	Delco	1200
90	G. E.	600
100	G. E.	700
75	G. E.	1200
50	A. C.	1200
40	Rel.	1750
42	ABC (2)	1200
30	G. E.	1200
25	G. E.	1200

125 V.D.C. Motor Driven

KW	Make	Speed
150	West. (2)	1150
100	West. (2)	900
100	G. E.	1200
100	El. Machry.	1200
75	Cr. Wh.	1200
50	Sturt.	2800
50	West. (2)	1150
35	G. E.	1750
35	Ideal	1200
30	G. E.	1150
30	L. A.	1450
25	El. Machry.	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
5000	Chandeysson	19/38
125	Hobart (8)	7½
1500	Century	24
2000	G. E.	24V
100	G. E.	30
1000	G. E.	33
150	Watton	40
1000 (3)	Chandeysson	40
200	G. E.	42
1500	G. E.	50
1500	Century	60
1500	G. E.	60
1000	G. E.	75

FREQUENCY CHANGERS AND GENERATORS

Size	Make	Output Frequency
150 KW	G. E.	150 cy.
154 KVA	G. E.	150 cy.
50 KW	G. E.	120 cy.
40 KW	G. E.	100 cy.
30 KW	G. E.	90 cy.
15 KW	G. E.	408 cy.
10 KW	G. E.	200/700 cy.
7½ KW	G. E.	408 cy.
3 KW	G. E.	408 cy.

TRANSFORMERS

2—400 KVA Maloney Dry Auto—220 to 440 V.
1—300 KVA, Al. Ch. 3 ph. 4160V/230 V.
1—300 KVA. Pittsburgh, 3 ph. 4160V/230V Secondary.
3—150 KVA West. 2300/4100—110/220V.
4—25 KVA West. 440/110V.
60—Additional Oil and Insulated Dry-type Transformers in stock, not listed, down to 1 KVA.

STARTERS—A. C.

1—450 H.P. West. magnetic reduced voltage (550 V.) Synch.
1—250 H.P. C-H Bulletin No. 9589 4150V.
1—200 H.P. G.E. CR-7065, 440V.
3—150 H.P. G.E. CR-7061, 220V.
2—100 H.P. C-H 220 V. Synch.
40—C-H and A-B; 2 and 4 speed.

STARTERS—D. C.

1—600 H.P. 230V. West. magnetic.
150—New 230V. D.C. magnetic starters, from 5 H.P. to 75 H.P., C-H, G.E., etc.
40—New 7½ H.P. 230V. magnetic reversing.
1—300 H.P. West. 115V. magnetic.

TRAVELING CRANES

125 Ton Niles, 60'9" Span.
2 Ton Harnischfeger, 26' 8¼" Span

Partial List ONLY

EST. 1910 — L. J. LAND INC. — 41st YEAR

156 GRAND STREET — Phone CAnal 6-6976 — NEW YORK 13, N. Y.

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Ph., 60-Cy.

Qu.	HP	Make	Type	Volts	RPM
1	400	G.E.	18	2300	514
1	400	G.E.	KT-412	2300	450
1	300	Al. Ch.	AB	440	1760
1	250	Whse.	CS	2200	1160
1	200	Al. Ch.	AB	220/440	580
2	125	Al. Ch.	AB	2200	1750
1	125	Whse.	CS-761	440	1750
1	125	G. E.	KT-503	2200	875
3	125	C.W.	1284	440	430
3	100	Whse.	CS-663	440	1750
1	100	Al. Ch.	AB-228	2300	1160
5	100	F.M.	HS-201C	440	880
1	100	Al. Ch	AB	550	690
1	100	F.M.	H-241B	440	450
1	100	Whse.	CS-9.5	2300	514
1	100	Al. Ch.	AB	440	695

SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

Qu.	HP	Make	Type	Volts	RPM
1	2000	G.E.	MT	2200	256
1**	2000	G.E.	MT-30	2300	240
1**	1500	Al. Ch.	ANY	2200	230
1**	1200	Cr. Wh.		2200	257
2**	1000	Al. Ch.	ANY	2200	233
1	1000	Whse.	CW	2200	444
1**	600	G.E.	MT-412	2200	719
2	500	G.E.	I-16-M	2200	450
1***	400	G.E.	MT-574	550	585
1**	400	G.E.	I-M	2300	590
1**	400	Al. Ch.	ANY	2200	585
2	400	G.E.	MT-412	2200	440
1	300	G.E.	I-E15-M	2200	1200
1	300	Al. Ch.	ABT	2200	585
1	250	Al. Ch.	ABY	440	440
1	250	Whse.	CW-1106	2300	580
1	250	Whse.	C.W.	550	514
1	250	G.E.	MT-414	2200	300
1	200	G.E.	IM	2200	600
1	150	G.E.	I-E13 M	2200	1750
1***	125	Whse.	C.W.-870	2200	900
1	100	F.M.	420-C	440	900

—Mill type pedestal bearing. *—3-bearing.

SYNCHRONOUS MOTORS
3-Ph., 60-Cy.

Qu.	HP	Make	P.F.	Volts	RPM
1	4000	Whse	.8	5000	600
1	2500	Whse	1.	4800/2400	720
1	1500	Whse	.8	2200	720
1	700	G.E.	.8	2300	720
1	450	G.E.	.8	440	900
1	400	Whse	.8	440	600
1	268	Al. Ch.	1.	2200	900
2	250	Al. Ch	.9	2200	514
1	200	Whse	.8	440	900
1	150	G.E.	1.	2200	900
1	150	G.E.	.8	550	450
1	150	G.E.	.8	2200	600
1	125	El. Mch.	1.	1800/2400	900
1	125	G.E.	.8	2200	900
1	100	Whse	.8	440	1800
1	100	Whse	1.	2200	1200
1	100	Whse	.8	440	900
2	100	G.E.	.8	440	600

With the above we can supply manual, semi-magnetic or full magnetic, reduced or full voltage control.

TRANSFORMERS—(OIL COOLED)

Qu	K.V.A.	Make	Type	Phase	Voltage
2	4500	G.E.	HT	3	27000/13500/2300
3	4000	G.E.	H	3	22000/2300/4000 Y
1	3750	Whse	S	3	67000/14400/2400
1	3000	G.E.	HT	3	14400/13200/480
3	500	G.E.	H	1	13200/11880/220/440
30	100	G.E.	HT	1	14400/12870/240/480
1	100	Whse	AUTO	1	2400/4160Y/1385/2400Y
3	100	Whse	SS	1	12075/10955/230/460

MOTOR GENERATOR SETS

Qu.	KW	Make	R.P.M.	Volts DC	Volts AC
1	2400 (3U)	Al. Ch.	720	525	4800/2400
1	2000	Whse	600	600	2300
1	1500	Whse	514	250	4600/2300
1	1500 (3U)	Al. Ch.	720	525	4800/2400
2	1000	G.E.	514	575	4000/2300
1	750	Whse	900	600	2300
1	700 (3U)	G.E.	720	250	2300
1	600	G.E.	720	300	2300
1	500	Al. Ch.	720	525	2300
1	500 (3U)	Whse	1200	250/240	4000/2300
1	200	Whse	900	250	2300
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	Al. Ch.	1200	250	2300/440
1	100	Ridgeway	1200	275	4000/2300
1	85	C.W.	1200	250	2300/440
1	75	Whse	900	275	2200
1	75	Al. Ch.	900	250	2300
1	75	Star	1200	230	440/220
2	25	Whse	1200	120/240	440/220

3U—3 unit set.

ROTARY CONVERTERS

2025/2565 K.W., 225/285-V D.C., G.E., 9900 Amp., 450-H.P.M., with booster.
2760—K.V.A. Trans., 6900-V, 3-PH., 60-CY., complete control. & C.D. distribution cubicles.
Will Rewind Transformer to Suit Your Current.

DIRECT CURRENT MOTORS

Qu.	HP	Make	Type	RPM
1***	3000	Whse	Encl (Rev)	600
1***	2400	Whse	Encl (Rev)	600
1***	1600	Whse	Encl (Rev)	600
6***	1500	Whse	Encl (Rev)	600
1***	1200	Whse	Encl (Rev)	600
2***	1250	Whse	Mill (Rev)	300/600
1***	800	Whse	Encl (Rev)	600
1	400	Al. Ch.	Mill	400/1200
1	350	G.E.	CD 169	1150
1	225	Whse.	QM	450/900
1	200/250	El. Dy.	#22	400/1200
1	200	Whse.	Mill (Rev)	300/1200
1	180	G.E.	MPC	400
1	150	Al. Ch.	Mill (Rev)	400/1200
2*	150	Cr. Wh.	83H	890
1***	125	Whse	SIC-190	600
1	100/125	Rel	1095 F	300/1200
2	100	Rel	1050 T	400/1200
1	90/160	G.E.	MPL	625/1125
1*	50/75	Rel	1095 F	300/1200
1*	30/75	Whse	SK 151 L	400/1200
1	50	Whse	SK	300/1200
1	40	Al. Ch.	E 127	850/1750
1	35	G.E.	CD 125	400/1200
1	35	G.E.	CD 147	300/1200
2	35	G.E.	HP 14	500/1500
1	25	Rel	T	250/1000
1	22½	Whse	SK 150	400/1200
2	25	G.E.	CD 123	400/1200

Above are all 230 V DC except where marked ***
***—Pedestal Bearing 525/600 V DC Mill design
Rev.—(designed for mill reversing service) *—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

Quality SINCE 1906

Wente Motors

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT... BY EXPERTS

SQUIRREL CAGE
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	G.E.	1 (2200 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	KT Vert.	1800
4	60	G.E.	KT (2200 V.)	1200
4	60	G.E.	KT547Y (2200 V.) SP	1200
1	60	West.	CS (TEFCBB)	1200
1	75	West.	CS (TEFCBB)	1200
1	60	West.	CS Gearhead	532
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	NTP	1200
1	120	G.E.	FT	3600
3	125	Al. Wh.	AR (BB)	450
2	150	Al. Ch.		1750
1	250	G.E.	KF (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

1	50	Ideal	AV	600
1	50	G.E.	I	700
1	60	Ideal	AVX	1200
1	70	KW G.E.	TS (7PF)	1200
1	75	West.	CW	400
1	75	G.E.	I	520
1	75	Fr. Morse	BV (2200 V.)	1800
4	100	G.E.	I-16 (2200 V.)	450
1	100	KW G.E.	ATB (8PF)	900
4	100	G.E.	MT566Y (2200V.18P	450
1	100	G.E.	MT536	900

Qu.	HP	Make	Type	Speed
1	125	Fr. Morse	T (2400 V.) (PF1.0)	900
1	150	West.	CW	450
1	200	West.	CW (3 Bear.)	600
1	835	Krs R.M.	(.8 PF)	900

D.C.—230 VOLT
(Other voltage as noted)

1	50	West.	SK	350
2	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	700
2	75/100	Reliance	T7050	300/900
2	75	West.	SK, frame 163	850
1	100	West.	SK, frame 160	1200
1	100	Cr. Wh.	CM	600
1	130	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	400/1200
1	150	West.	SK	350
1	200	Cr. Wh.	CMC	450
2	200	Reliance	T2550	300/900
2	200	G.E.	TLC-74	1350/4000
1	250	West.	SK	1050

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
2— 75 KW El. Prod. 220 V DC—440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 900
1—100 KW Reliance 250 V DC — 220 V AC 1200
1—100 KW Ridge 275 V DC — 440 V AC 1200
1—150 KW G.E. 275 V DC — 440 V AC 900

ALSO—4000 motors other than listed from 1 HP to 300 HP.

Wente SINCE 1906 — *The Wente Electric Co.,* Hamilton — 203 NO. FOURTH ST. Phone 4-8128 — Ohio

JOHN H. BENSON ROY L. WILIMZIG

PUMPS!!

2—20"x16" Economy AA511, 12000 GPM, 75' Hd. 1200 RPM; 300 HP Motor and starters; NEW 1948.

2—Ditto, except 40' Hd. and 900 RPM.

2—10"x8" Morris No. 6S Slurry Pumps, 900 GPM, 100' HD, 875 RPM, 60 HP, with or without motors.

1—Northern Hydraulic 3000 PSI, 99 GPM, Size 5820, 580 RPM, NEW SURPLUS.

1—4" GOULDS 500 GPM, 1320' Hd. 3500 RPM, Fig. 3360, 250 HP.

1000 OTHER PUMPS IN STOCK!
PHONE, WRITE OR WIRE!

C & S MACHINERY CO.
1708 N. 8th St.
St. Louis 6, Mo.
GA-4290

TWO STOKERS, COMPLETE

Detroit Overfeed Rotostoker—double feed. Capacity: 500 boiler H.P. Grate area: 45 sq. ft. Grate dimensions: 6 ft. x 7 ft. 6 in. Stokers complete with forced draft fans. Stoker parts: 4 feed units, 2 drive units, 2 blower fans, 2 wind tunnels, 2 set grates, 2 boiler fronts for mounting feed units.

PURITY BAKERIES
97 E. 12th St. St. Paul 1, Minn.

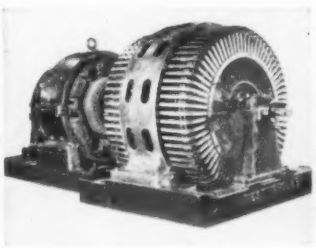
IT ISN'T RE-NU-BILT UNLESS

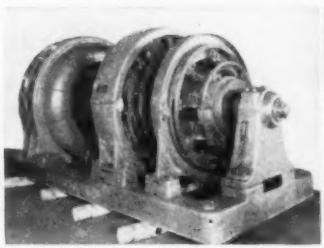
It Comes from

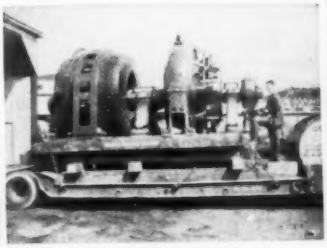
BELYEA

"SUCCESSFUL OPERATION GUARANTEED"

Three Recent Stock Arrivals







500 KW-MG

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
2	2000*	G.E.	500		6600/11000
1	1800	G.E.	600	125/250	4000
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2200/4400
1	1000	Whse.	900	600	2300/4150
1	1000	West.	514	250	4150
1	1000	G.E.	900	600	2300/4150
1	800	Whse(3U)	1200	600	2300
1	800	G.E.(3U)	1200	120/240	2300
1	750	Whse.	900	250	2300
1	500	G.E.	720	125	2300/4000
1	500	Whse.	900	250	2300/12000
1	500	Whse.	900	250	440
1	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	400	Whse.	1200	250	2300
1	350	G.E.	900	125	2300/4150
1	200	G.E.	1200	275	2200
1	150	Whse.	1200	275	2300
1	150	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh.	900	125/250	2300
1	100	G.E.	1170	125	220
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	Cr. Wh.	1170	250	220/440
1	75	G.E.	1200	250	440
6	70	G.E.	1200	70	220/440
1	60	G.E.	1200	250	2300
1	50	Whse.	1200	120	220

* 25 Cycle

ROTARY CONVERTERS

60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000
1	750	Whse.	900	600	13200

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	G.E.	Condensing 135/150# ISP 2300/4150 V 3 ph. 60 cy.
2	750	G.E.	Condensing 425#-725°TT ISP-440V-3 ph. 60 cy. New—1945
1	625	Whse.	Non-condensing, 125/150# ISP, 5/20# B.P., 480 v., 3 ph., 60 cy., with exciter
1	490	Whse.	Non-condensing 125/150# ISP 5/10#BTU 40/480v. 3 ph. 60 cy.
2	400	G.E.	Condensing 275# ISP Geared to 1200 RPM. 120/240V. D.C. Generator.
1	380	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM 120/240V. D. C.
2	200	Cr. Wh.	Condensing 250# ISP GEARED to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 75 B.P. 240V. 3 ph. 60 cy.

750 KW-MG

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse.		600	525/730
1—1500	Whse.		525	600
1—940	Whse.	QM-R Brg.	250	140/170
1—800/1000	Whse.		450	600/720
1—650	G.E.	MPC	250	115/145
1—600	Al. Ch.	MILL	230	400/800
1—300/400	G.E.	DYNA	250	1325/2500
1—350	Cr. Wh.	CCM-151H	230	1100
1—335	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	250	300/920
1—275	Whse.	QM-600-8	230	425/850
1—250	G.E.	MPC	230	460/500
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	800
1—150	Cr. Wh.	CMC-65H	230	1150
1—150	Cr. Wh.	CCM-152H	230	300/1050
1—50/120	G.E.	MCF	230	25c/1900

FREQUENCY CHANGERS

1—1000	A.C.	25/62½ Cycle	2300/2300
1—1000	G.E.	25/58 Cycle	4400/2300
1—500	A.C.	25/60 Cycle	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4800	720

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
3	2666	Whse.	OISC	1	6600/11000
1	2500	Al. Ch.	OISC	3	13200x2300
3	1250	G.E.	H	1	6600x500
1	1000	G.E.	HT	3	13200x2300/4600
1	1050	G.E.	WCTH	3	11000x445
3	667	Whse.	OISC	1	66000/34500x23000/2300
1	600	Al. Ch.	OISC	3	4000/2300x216
1	600	G.E.	HT	3	13200x2300/4600
1	500	Whse.	OISC	1	34650x182
8	333	Maloney	C	1	7620/13200x120/240
3	333	Pitts.	OISC	1	26400x2600
3	150	Maloney	OISC	1	13800x2300/4600
1	100	G.E.	H	1	450x230

RECTIFIERS

1— 750	G.E.	BBW	575	2300
1—1000	A.C.	B-612	625	13500
1—1000*	A.B.B.	GRZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.

2000 KW-MG

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TS	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse.		2300	120
3—1470	Whse		4800	900
2— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	360
1— 450	Whse.	Eng.	2300	138.5
2— 350	G.E.	TS	2300	150
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 225	G.E.	ATI 1-Brg.	440	900
1— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600

SLIP RING

1—1000	Whse.	CW	2300	444
3— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	585
1— 500	G.E.	IM-Mill	2200	450
1— 350	G.E.	MT-442Y	2300/4000	253
1— 300	Al. Ch.	3 Brg.	2300	585
1— 300	G.E.	IM	440	720
5— 300	Al. Chal.	ANY	2200	705
1— 250	Al.Chal.	ANY	440	565
1— 250	G.E.	M-567-TEFC	440	600
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1754
1— 250	Al. Chal.	ANY	550	600
1— 200	Al. Chal.	ANY	440	450
2— 150	G.E.	IM-15	440	695
1— 150	Al.Chal.	ANY	440	580
4— 125	G.E.	MT-566Y	440/2200	435
4— 100	G.E.	MT-566Y	440/2200	435
2— 100	G.E.	IM-16	2200	435
2— 100	G.E.	IM	440	885
3— 100	Al. Ch.	ANY	440	695

SQUIRREL CAGE

1—1750	G.E.	KP	4160/6900	900
2— 650	G.E.	FT5593Y	440	3570
2— 450	Whse.	CS	2200/4150	854
1— 200	G.E.	IK	550	885
1— 200	G.E.	KT-587	440	1800
1— 200/113	G.E.	KP-559BS	440	1170/885
3— 150	Watghse.	CS8568	440	880
1— 125	Whse.	MS	440	485
1— 125	(New) G.E.	KP-TEFC	440	1190
1— 125	G.E.	KP-TEFC	440	3585
3— 125	Al. Ch.	ARW	2200	1750
1— 125	G.E.	IK	220	900
1— 100	Al. Ch.	AB	2200	1170
1— 100	G.E.	IK-Vert.	2200	450
2— 100	G.E.	KT-543	220/440	1750
3— 75	G.E.	KT-547Y	2200	1160

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, Inc.

43 HOWELL ST., JERSEY CITY, N. J.

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MOTORS • GENERATORS • TRANSFORMERS

200 KW M.G. SET

200 KW Westinghouse NEMA Frame Generator 250 V. DC 1200 RPM direct Connected to 300 HP. Westinghouse Synchronous Motor 3/60 220/440 Volts 1200 RPM. AC & DC Panels—Like new. Ship now.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP. 3/60/440/1800 Gen. Elect. Motor.

600 HP REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL Size 30/16 Speed 730 RPM to 115 RPM.

25 CYCLE TRANSFORMERS

3—1667 Wagner transformers. 1 Phase 25 cycle 23000 Volts primary. 575 Volts secondary.

MOTORS

60-50-25 Cycle in Stock—All Sizes

Slip Ring—Squirrel Cage—Synchronous

All types of Control Equipment.

ALL ITEMS IN STOCK FOR IMMEDIATE SHIPMENT

NIAGARA TRANSFORMERS

1 Phase — 60 Cycle — New

Stock Shipment on sizes listed. Short delivery on sizes up to 5000 KVA—1 or 3 phase, in voltage ratings to 69 KV. Standard taps. Built to A.I.E.E. —N.E.M.A.—A.S.A. Standards.

LISTING OF TRANSFORMERS

Quantity	KVA	Primary	Secondary
3	15	7200/12470Y	240/480
3	15	2400/4160Y	240/480
3	25	2400/4160Y	120/240
6	25	2400/4160Y	240/480
3	25	7200/12470Y	240/480
3	37½	2400/4160Y	120/240
3	37½	2400/4160Y	240/480
6	50	2400/4160Y	240/480
3	75	2400/4160Y	240/480
3	167	2400/4160Y	240/480
3	167	2400/4160Y	120/240
3	250	2400/4160Y	240/480

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

FAIRBANKS MORSE DIESEL GENERATOR

80 HP, 300 RPM, 2300 Volt, 3 Phase, 60 Cycle, Type KVA in excellent shape, complete with belted exciter. On foundation Winter, Wisconsin **$750.00**

RIDGEWAY 400 HP AC ENGINE GENERATOR

22"x24" NRC, No. 3651, 250 KW, 240 Volt, 180 RPM complete with belted exciter and switchboard. On foundation Topeka **$5,000.00**

We carry a complete stock of power equipment, new and rebuilt.

PORTER ELECTRIC COMPANY, INC.

116-118 THIRD AVENUE NORTH MINNEAPOLIS 1, MINNESOTA

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Motor Generator Set

Complete with control panel, meters and oil circuit breakers

G. E. Direct Current Exciter—20 K.W. 70 Amp. 115 volts

Synchronous G.E. Driving Motor 710 H.P. 750 R.P.M. 2300 Volts 140 Amps. 25 Cycles

Synchronous G.E. Driven Motor 550 Volts 3 Phase 525 Amps. 750 R.P.M. 62½ Cycles

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Boilers, water walls, stokers, turbo, steam and Diesel Electric units, transformers, air compressors and large motors.

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Union Iron Works, 535 h.p. horizontal tubular Boiler, 3 drum, A.S.M.E. Code, 199# steam pressure, complete with the following: Superheater, boiler meter, soot blowers, electric eye, coal pulverizer, steel coal bin and bucket conveyor, new 1930, condition good. Sacrifice for quick sale.

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COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

BOILER UNITS

4—600 HP B & W Sectional header 250#—superheat

1—140,000# New Steam Generator 600#, also Super
2—70,000# 500 psi
2—60,000# B&W 450# superheat
2—30,000# B&W 450# superheat
1—1250 B&W Sectional header 280#—super
1—1000 HP Erie City Boiler, 200#
1—700 HP B&W Sectional header—Super
1—400 HP Erie City 200# (can ship assembled)
1—45,000# F-W 450# 3 drum, water walled & economizer—superheat
Also smaller Boilers & Fire Tube Boilers

TURBO UNITS

2—10,000 KW Turbo-Generator—Cond.
1— 7,500 KW Turbo-Generator—Cond. 600#
1— 5,000 KVA Turbo-Generator 450# with condensing equipment
2— 5,000 KW Turbo-Generator—Cond
2— 3,000 KW Turbo-Gen. and Cond..one aut. extrac.
2— 2,500 KW Turbo-Generators and Condensers
3— 2,000 KW Turbos & Condenser
2— 1,500 KW Turbos & Condenser
2— 1,250 KW Turbos & Condenser } Also 400# & 600# turbos
2— 1,000 KW Turbos & Condenser
1— 500 KW same—Also 750 KW & 300 KW Units
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Potassium Permanganate Zeolite Filter. Includes 30 cu ft tank—Cypress preparation tank and approximately 30 cu ft mineral. Will sell mineral separately.

W. T. LEATHAM
510 Harwood, Jackson, Michigan

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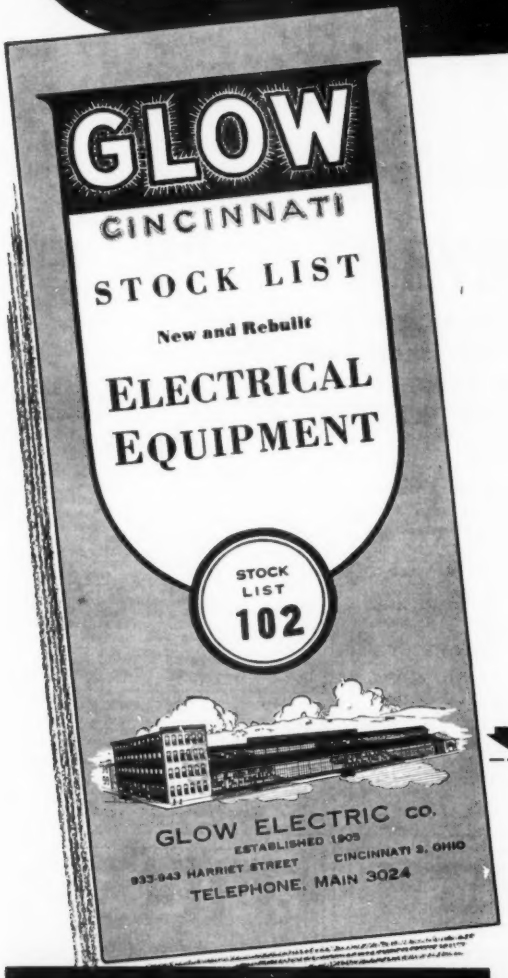

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HEMPHILL EQUIPMENT PROVES ITS VALUE

Member of The National Industrial Service Association, Inc.

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Pyranol	3	4150 x 2400
1	1000	GE	Auto	3/2	4150 x 2400
1	1000	GE	Auto	3	3810Y-2300Y
1	800	Kuhl.	OISC	1	4600 x 2300V
3	400	GE	H	1	6900 x 2250V
1	300	Pitts.	ODSC	1	7900 x 440V
3	250	Maloney		13	800 pri., 220/440 sec.
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	KS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
3	100	Wagner	RCKV	1	240 x 120/120
2	100	Whse.	SK	1	4400 x 220/440 Taps
2	100	Newark	Dry	3/2	440 x 220

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
2	1500	GE	600	275	4000 Syn.
1	1000	GE	514	600	4000 Syn.
1	1000	GE	514	600	2300/4150 Syn.
1	300	GE	1200	250	2300 Syn.
1	180	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El.Mach.	1200	125	4150 Syn.
2	75	GE	1200	250	220/440
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	50	Ridgeway	1200	550	220/440 SC
1	50	Whse.	900	250	220/440 SC
2	40	El.Mach.	1750	125	440 SC

SLIP RING

1	2500	GE	MT	6600	257	
1	300	Whse.	CW	440	600	
1	250	Whse.	CW	440	600	
1	200	Whse.	CW	440	600	
1	100	GE	IM	440	400	
1	75	GE	MT	220	1200	Vert
1	75	GE	MT	440	900	
1	60	GE	MT	220	1750	
1	60	GE	MT	440	900	
1	50	GE	MT	220	1720	
1	50	GE	MT	220	1200	
1	50	Whse	CW	220	900	
1	50	GE	MT	220	1700	
1	50	GE	MT	220	600	
1	40	GE	MT	220	1200	
1	40	GE	MT	2200	1200	

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1604 53rd STREET, NORTH BERGEN, N. J.
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JANUARY SPECIAL

1—1250 HP; 3—600 HP; 2—400 HP; 1—375 HP; 1—250 HP; Babcock & Wilcox straight tube forged steel; sectional header, A.S.M.E. and National Board Code water tube boilers, all with superheaters, soot blowers, pop safety valves, non-return valves and all other boiler trim. Three Boilers have 1947 spreader stokers.

CONDENSING TURBINES

1—10,000 KW; 1—5000 KW; 1—3000 KW; 1—200 KW; 1—1000 KW; These turbo generators are complete with condensing equipment, etc.

All boiler feed pumps, late type feed water heaters, coaling and conveyor facilities including modern drag scraper, heater exchangers, numerous valves, piping and electrical equipment.

HOWE BROTHERS

342 MADISON AVE., NEW YORK 17, N. Y.
Phone — MUrray Hill 2-8562-63-64

FOR SALE
TWO 300 H.P. BOILERS & ACCESSORIES

Complete steam generating plant. Two Keeler Type CP, two drum, bent tube, water cooled furnace type boilers with heating surface 3000 sq. ft. each. W.P. 250 psi and nominal 300 HP each. Steam rating 9880 lbs. per hr. at 100% nominal rating. Riley-Jones stokers, single retort with moving grates 59 sq. ft. projected area, steam ram drive. Clarage fans 9825 c.f. per min. at 4 in., one steam turbine, one electric drive. Meters and instruments. Boiler feed pumps. Deaerating boiler feed water heater. All installed 1942. Now in use and good condition in northern Ohio. Available approximately Nov. 1951.

Contact BURGESS & NIPLE, *Agents*
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1000 KW, 2300 volt Gen. Elec. REBUILT condensing turbine 175 S.P.
300 KW 240 V Westinghouse geared Nonsand. turbine
400 KW 480 V 1200 RPM Elliott generator with 1200/4500 gear
285 KVA 240 V Chase Inflow engine set.
2000 Amp. 3-pole GE Air breaker with Bus Duct.
300 & 200 KW Syn M.G. Set with control.

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PIONEER TRANSFORMER REBUILDERS

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One Year Guarantee.

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NEW-USED RECONDITIONED

Steam, Gas and Electric Power Equipment

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MURRAY HILL 7-6547-8-9

WORLD'S LARGEST INVENTORY

Established 1934 — D & B Rated

MOTOR GENERATOR SETS AC — DC

Quan.	KW	Make	Volts
1	1000	General Electric	250
6	1000	General Electric	600
2	500	Westinghouse	250
2	500	Westinghouse	1500
1	500	Westinghouse	125
1	400	Westinghouse	125/250
2	300	General Electric	125/250
1	300	General Electric	500
1	250	General Electric	250
1	200	Westinghouse	250
1	200	General Electric	250
2	200	General Electric	125
1	150	General Electric	250
1	150	General Electric	125
3	100	General Electric	125
4	100	General Electric	250
1	100	Allis-Chalmers	125/250

Plus 238 sets from 1 KW to 75 KW in stock.

DC TO AC

Input		Output
1	300 HP—230 V	200 KW, 440/60/3
1	125 HP—230 V	75 KW, 125 V, DC
1	25 HP—230 V	15 KW, 230/60/3
1	25 HP—230 V	15 KVA, 230/60/1
35	20 HP—230 V	12½ KVA, 440 V, 3 ph, .5 P. F.
40	7½ HP—230 V	7½ KVA, 120/60/1
20	6 HP—115 V	5 KW, 120/60/1
5	3 HP—115 V	2 KVA, 110/25/1
10	1½ HP—115 V	1 KVA, 110/60/1
10	1 HP—115 V	½ KVA, 110/60/1

ROTARY CONVERTORS

Quan.	KW	Make	Speed	Volts
5	500	General Electric	1200	250
7	400	Westinghouse	1200	250
1	100	General Electric	1200	250

P.S.—We Stock Explosion-Proof Motors—Class 1-D & 2-G

AC GENERATORS—ALTERNATORS—CONDENSERS

Quan.	KVA-HP	RPM	CYCLE
1	2500	720	60
1	2500	900	60
1	1675	600	40
2	1500	900	60
1	1430	514	60
1	1250	1200	60
1	1000	750	25
1	800	900	60
3	750	900	60
2	650	139	60
1	500	720	60
1	500	750	25
1	400	450	60
3	400	1800	60
1	350	750	25
1	350	720	60
1	350	225	60
1	333	1800	960
1	320	1200	120
1	300	750	25
1	300	180	60
1	250	720	60

Plus 78 smaller units from 3 KVA to 200 KVA

60 CYCLE MOTORS

SQUIRREL CAGE MOTORS

HP	SPEED	MAKE
500	720	G. E.
400	1200	West.
400	514	West.
300	600	West.
250	3600	G. E.
250	1200	G. E.
200	600	Al. Ch.
200	1800	Wagner
150	720	G. E.
150	600	G. E.
150	1200	Al. Ch.
150	1800	Al. Ch.
125	900	G. E.
100	900	West.

P.S. We stock 3500 new and rebuilt 1 HP to 100 HP

SLIP RING MOTORS

Quan.	HP	Speed	Make
1	600	1800	G. E.
1	500	1800	G. E.
1	500	514	Al. Ch.
4	500	900	G. E.
1	350	720	G. E.
1	300	450	G. E.
1	300	514	G. E.
1	300	900	G. E.
1	300	720	G. E.
1	200	600	G. E.
1	200	1200	G. E.
2	150	720	G. E.
1	125	1200	Al. Ch.
1	100	900	Wagner
4	100	450	G. E.
3	75	720	West.
6	75	900	West.
2	60	1800	G. E.
8	50	900	Cr. Wh.

Plus 637 smaller units 1 HP to 40 HP

You Can Rent Any Equipment In Our Stock We Will Buy For Cash, Your Surplus Or Swap

TRANSFORMERS

Quan.	KVA	Primary Volts	Secondary Volts	Phase
2	3000	23,000	2300	3
1	1500	2,300	690	3
1	1000	2,300	220	3
6	1000	66,000	7200	1
3	750	2,400	480	1
6	500	2,400	480	1
3	500	12,000	2300	1
3	450	23,000	440	1
3	333	2,400	600	1
3	333	2,400	240/480	1
3	333	13,200	240/480	1
3	333	11,500	240/480	1
3	300	2,400	120/240	1
6	250	2,400	240/480	1
3	250	4,150	120/240	1
3	200	2,400	240/480	1
3	150	2,400	240/480	1

Plus 734 smaller units 1 KVA to 100 KVA

DC MOTORS

ADJUSTABLE SPEED—230 VOLT

Quan.	HP	Make	Volts
1	300	General Electric	400/800
1	250	West.	250/675
4	40/250	West.	540/3000
1	150	West.	300/900
1	100	Reliance	500/1500
1	100	G. E.	400/1000
1	100	West.	450/1350
1	100	G. E.	1050/4000
1	90	F. M.	500/1500
1	75	G. E.	400/1200
1	60	G. E.	220/1000
1	60	G. E.	300/1200
1	50	G. E.	250/1000
1	50	G. E.	400/1200
1	40	G. E.	250/1000
1	40	Cr. Wh.	400/1600
1	35	West.	250/1000
1	35	G. E.	500/1000
1	30	Reliance	400/1200
1	30	Cr. Wh.	500/1500
1	25	Reliance	400/1600

Plus 327 smaller units 1 HP to 20 HP

CONSTANT SPEED—230 VOLT

HP OR KW	MAKE	SPEED
400 HP	Elec. Dyn.	1500
300 KW	G. E. (170 V)	1200
300 HP	Cr. Wh.	1200
250 KW	Al. Ch.	720
150 KW	West.	720
125 HP	Star	1200
100 HP	G. E.	900
75 HP	G. E.	1200
75 KW	G. E. 325 V	1200
50 HP	West.	1200
50 HP	Burke	1800

Plus 675 smaller units 1 HP to 40 HP also

115 V & 550 V, DC. We stock 110V. & 600V. Motors.

SQUIRREL CAGE AND SLIP RING—25 CYCLE

Quan.	HP	Speed	Make
1	650	365 rpm	S.R.
1	350	750	S.C.
1	300	750	S.C.
1	300	375	S.R.
4	200	500	S.R.
1	200	750	S.R.
1	200	750	S.C.
1	200	500	S.C.
1	200	1500	S.C.

Plus 872 smaller units 1 HP to 150 HP

COMPRESSORS

1—3000 CFM	Ingersoll—Steam
1—3000 CFM	Sullivan
1—1350 CFM	Ingersoll
2— 850 CFM	Ingersoll
2— 400 CFM	Chicago
2— 196 CFM	Ingersoll

We stock new units 6 CFM to 290 CFM

Note: We Stock 6000 New Motors, Controls, Frequency Changers

SEND US YOUR INQUIRIES!

ELECTRIC EQUIPMENT COMPANY

PHONE LD65

New and Rebuilt — ROCHESTER, N. Y. — 1 H. P. to 2500 H. P.

MOTORS — MG SETS — TRANSFORMERS — CONTROLS — COMPRESSORS

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2300	G.E.	1800
500	2300	G.E.	450
450	440/220	Whse.	514
300	440	Whse.	3600
250	440/220	Whse.	600
200	440	G.E.	450
185	4000/2300	G.E.	1800
150	440/220	Whse.	900
150	440/220	Whse. (3)	1800
150	440/220	G.E.	720
145	4000/2300	G.E.	1800
100	440/220	G.E.	900
100 (3)	440/220	Whse.	900
100	2200/550	G.E.	1800
80	440/220	G.E. (MTC)	900
75	2300/550	G.E.	1800

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	900
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	900
250	4000/2300	El. Mshy.	Rgn.	600
240	2300/440	G.E.	ATI	750
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2300/440	Whse.	GE	900

GENERATOR SETS

2—unused 25 kva, 120/280 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2200	Cr. Wh.	SC	1800
350	2200	G.E.	KT	1200
350	3200	G.E.	FT	3600
300	2200	G.E.	KT	1800
300	2200	G.E.	KT	1200
250	2200/440	L. Allis	OGS	1200
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	440/220	G.E.	KF	720
200	2200/440	G.E.	SC	900
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	G.E.	KT	1200
150	440/220	Howell	D. Brg.	1800
150 vert.	440/220	G.E.	KTF	1200
150	440/220	G.E.	IK	514
150	440/220	Whse.	CS (NEW)	900
100	2200/440	G.E.	K	1800

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—225 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
3— 75 kva, 1800 rpm, 480/240 V., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (3)	G.E.	CD	1150
250	230 (3 new)	Cr. Wh.	CMC	1900
150	230	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	635
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—300 kw, 1200 rpm, 250 v., G.E., connected to 500 hp, 1200 rpm, 2200/440 v., synchronous
1—165 kw, 1200 rpm, 240 v., G.E., conn. to 280 hp, 1200 rpm, 440/220 v., squirrel cage
1—100 kw, 250 v., Hartner, 1200 rpm, connected to 150 hp, 2200/440 v., synchronous
1—75/90 kw, 250 V., 1200 rpm, G.E., conn. to 135 hp, 440/220 V., sq. cage
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 130 hp, 2300/440 v., syn. motor.
1—50 kw, 250/125 V., 1200 rpm, 3 wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

TRANSFORMERS 60 Cy.

3—667 kva, Whse., 33,000—2300 V.
3—333 kva, G.E., 13,200—2300 V.
3—333 kva, Whse., 2400—480/240 V., Dry
3—250 kva, G.E., 6900/13,800—230/460 V.
3—250 kva, Whse., 11,000/22,000—2300 V.
2—250 kva., Whse., 2300—208 V.
3—200 kva, Whse., 13,200—2300 V. (Inerteen)
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse, SK, 13200-125/215 v., 3 ph
3—100 kva, Whse., 4600/2300—230/115 V.
6—100 kva, G.E., 4600/2300-230/115 v., NEW
3—100 kva, G.E., 450-115/230 v., dry, 1 ph, new
2—75 Kva, G.E., 480—240/120 v. Pyranol
3—60 kva, G.E., 480—240/120 V., Pyr

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

TRANSFORMERS

FOR SALE

2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
6 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

ATLANTIC TRANSFORMER CO.

5143 N. 2nd St. Philadelphia 20, Pa.

We Own and Offer from Stock

BOILERS

All ASME Code—Inspection Guaranteed

- 2 ea. 3504 HS HWW Cross Drum, Steel Sectional Heater WT; 350# WP; Steel Encased, integral furnace. Perfect 1934
- 3 ea. 420 HP, 166# WP, Erie City WT, complete with gas and auxiliary equipment. 1941.
- 1 #590 Kewanee, 125#, 2501 HS, 1941
- 2 #587 Kewanee, 125#, 1429 HS, gas. 1943
- 1 Titusville Scotch Marine 15#, Wet Back. No. SOH-242. 1941.
- Late 10-15-20 HP Vt. Tub. Boilers. Inquire.

S. I. JAFFE COMPANY

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P.O. Box 4111 37-8686

NAME YOUR OWN PRICE — MUST SELL AT ONCE —

COAL PULVERIZING EQUIPMENT consisting of

COAL CRUSHER — BONNOT Size 24" x 30", 2-rolls, with 30 HP AC motor.

COKE CRUSHER — BRAUN, Cap. 800# per hour with 4 HP AC motor

COAL DRYER—McNEIL, Size 5' dia. x 50' long. Weight 26,400# with 15 HP AC motor

STILL IN ORIGINAL LOCATION—IMMEDIATE SHIPMENT

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Nichol Ave., McKees Rocks, Pa.
Phone: FEderal 1-0746

1—used—2 cylinder Upright Troy Twin Engine 75 H.P. with Moore & White variable speed change—owner used to operate paper machine.

THE WRENN PAPER COMPANY

Middletown, Ohio

500-750-1000 KW Rotaries/M. Gen. Sets
250-200-150-125-100 HP Mtrs. Slip/Sq. Cage
30 Ton Diesel & Steam Locomotive Cranes
200-150-100-60 HP Erie Economic Boilers
1250 KW 250# Non-condensing Turbo Gen.
2—72x18 HRT Boilers, 150# Code
20 Ton 70' Span 3-Motor Overhead Crane

H. & P., 6719 Etzel, St. Louis 14, Mo.

Generator Voltage Regulators

New — Used — Sold — Exchanged — Rebuilt

Westinghouse Silverstat General Electric GDA Allis Chalmers Rocking contact for A.C. and D.C. generators all sizes for quick delivery.

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Diesel, Steam Turbine, Engine

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6040 Ft. INGERSOLL RAND 60 LB. ELECTRIC.
1—3865 & 1—4486 Ft. NEW CHICAGO PNEU. OCE. ELEC. 125 LB. W/MOTOR TO SUIT.
1700 Ft. IR. XRE. ELEC.
1579 Ft. CHGO. PNEU. DIESEL. 125 LB
1302 Ft. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
610 Ft. WORTHINGTON V BELT DRIVE 125 LB. WITH OR WITHOUT MOTOR.

DARIEN, 60 E. 42nd St., New York 17, N.Y.

USED WATTHOUR METERS

150 only G.E. 5 Amp. 1-14 110 Volt 2 wire Meters. All good—removed from lines to make way for 15 Amp 3 wire Range load.

KENWOOD ELECTRIC CO.
Sherrill, N. Y.

POWER EQUIPMENT—READY TO SHIP

Q.	HP	Make	RPM	Type
1 New	290	West.	1200	Syn.
1	250	G.E.	1150	I. E. Vert.
1	250	G.E.	1150	(2200 V.)
1	250	Burke	720	(2200 V.) Syn.
1	200	West.	720	CS-954A
1	200	G.E.	860	(2200 V.)
1	200	Al. Ch.	1800	(2200 V.)
1	200	G.E.	1800	T. S. Syn.
1	175	West.	600	C. S.
1	175	West.	1200	Hi Torque
1	150	West.	257	Syn.
1	150	West.	900	(2300 V.) Syn.
1	150	G.E.	900	ATI Syn.
1	150	West.	1200	MS Hi Torque
1	150	West.	500	CS-954A
2	150	L. Allis	1775	FX
1	125	El.Mh.	164	Syn.
1	125	West.	450	CS
1	150	West.	600	Syn.
6 New	125	West.	1200	Syn.
1	112	West.	1200	Syn.
1	100	FM	380	Syn.
1	100	Al.Ch	720	
1	100	West.	900	Syn.
1	100	West.	600	Syn.
1	75	El.Mh.	900	Syn.
1	75	Stanley	600	
1	75	Al.Ch.	585	
1	75	L. Allis	1150	Hi Torque
1 New	60	Rell'ce	1200	TEFC BB
1	75	L. Allis	1775	FX-505
1	75	Master	1750	TEFC
1	60	Al.Ch.	515	
4 New	60	West.	900	Exp. Proof
5 New	60	West.	900	TEFC
1 New	60	Rell'ce	880	TEFC
1	60	G.E.	1800	
1	60	FM	1200	Syn.
1	50	G.E.	1200	KT-326
1 New	50	Rell'ce	720	TEFC
2	50	G.E.	720	KT-546
1	50	Wagner	900	Fynn Meichel
1 New	50	Rell'ce	900	TEFC
1	50	G.E.	1200	
1	50	West.	1735	CS
1	50	Wagner	1750	TEFC
2 New	50	Reliance	1750	TEFC (2200 V.)
2 New	50	G.E.	1750	TEFC (2200 V.)
1 New	50	West.	1750	TEFC
2	40	G.E.	570	KT-546
1 New	30	G.E.	900	Hi Torque
1 New	30	West.	900	Hi Torque
1 New	30	L. Allis	1800/1200	
1	30	G.E.	1750	TEFC
1	25	West.	880	TEFC
3	25/6.2	Cont'l	1150/575	
1	25	West.	1150	CS-W-405
2 New	25	G.E.	1760	K-3642

GEAR MOTOR BARGAIN

50 HP G. E. 1755 rpm input 13 rpm output speed 220/440 or 550 v. A.C. 3 ph. 60 cy. splash proof ball bearing.

SPECIAL BARGAINS
Diesel Engine Generator Sets

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-8, 8½x7, 8 cyl. Superior DIESEL Engines, elec. start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—63 kva. 120/208 v. 3 ph. 60 cy. 1800 rpm., driven by Cat. DIESEL mt'd on trailer

1—86 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 360 rpm DIESEL

1—75 KW 220/440 v. 3 ph. 60 cy. International GASOLINE

2—75 kva. 220/440 v. 3 ph. 60 cy. Delco Cumming DIESEL

1—62 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 1200 rpm DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

10—NEW 37½ kva., 220/440 v. 3 ph. 60 cy. LeRoi Gasoline

1—31.3 kva. 120/208 v. 3 ph. 60 cy. G.E. Gen. driven by LeRoi GASOLINE

11—NEW 25 kva. 120/220 v. 1 ph. 60 cy. LeRoi GASOLINE

3—25 KW BRAND NEW Onan 220/440 v. 3 ph. 60 cy. 1800 rpm GASOLINE

1—12½ kva. 120/240 v. 1 ph. 60 cy. 1200 rpm., dir. con. Hercules GASOLINE

2—12 kva. 120/240 v. 1 ph. 60 cy. LeRoi GASOLINE

2—7½ kw. 120/208 3 ph. 60 cy. Buda GAS.

230 V. SERIES WOUND MOTORS

HP	Make	Type	RPM
15	G. E.	CO-1807	800
11	Westg.	K-8	475/630
40	Westg.	K-9	700

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Rpm	Volts
600	Ideal	1770	220/440
500	Ideal	1770	220/440
400	Ideal	1770	220/440
400	West.	428	2200
75	G.E.	450	220/440
60	G.E.	570	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West.	1200	220/440
10 NEW	37½	West.	900	220/440
3	25	Onan	1800	220/440
11 NEW	25	West. (1 ph.)	900	220/440

MOTOR GENERATOR SETS—250 V. D.C.
Motors 220/440 volt or 2200 volt

No.	KW	Make	Rpm
2	200	Westinghouse	1200
1	100	Westinghouse	720
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	880
1	100	Delco	1200

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw. West. 125 v. 1200 rppm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2300	575/460/345 288/115
3	500	G.E.	2300	220/440
6	333	Maloney	2300	230/460
3	200	G.E.	2300/4000	230/460
3	150	West.	2400/4160	240/480
3	150	Pgh.	2300	230/460
1	100	Peerless	2300	230/460

ENGINES

NEW 75 HP. P.&H. Model 387C 3 cyl. Diesel
Rebuilt 32 HP. Caterpillar Model D-3400 Diesel
NEW 43 HP. International Model U-6 4 cyl.

NEW AXIAL FLOW VENTILATING FANS

20—6000 cfm Sturtevant Bulletin 51238B 3" stat. pres. 7 blade dir. con 5/1.5 HP 1765/1175 rpm 220/440 v. 3 ph. 60 cy. Westg. TEFC Motors.

5—5000 cfm 3.2" stat. pres. Sturtevant with 3 speed 220/440 v. 3 ph. 60 cy. Motors

2—10,000 cfm LADEL dir. con. 2 speed 220/440 v. 3 ph. 60 cy. Motors

1—12000 cfm 2" stat. pres. with 3 speed 220/440 v. 3 phase 60 cy. Motors

2—16000 cfm 2" stat. pres. Buffalo Forge with 3 speed 220/440 v. 3 ph. 60 cy. Motors

1—67000 to 38000 cfm 1" to 2.2" stat. pres. Size 50" dia. 72½" l, 2 sets propellers International Eng. Co. driven by 100 HP AC Motor

A. C. HOISTS

2—NEW ½ ton Shaw 220/3/60 15' lift 21 fpm

230 V.D.C. MOTORS

2—New 250 HP. Allis Chal. 1750 rpm
1—60 HP. Westinghouse 850 rpm
2—50 HP. Westinghouse 1700 rpm

PLATING SETS

1—1000 amp. 25 v. G. E. driven by 40 HP 230 v. D.C. 1200 rpm mtr. (Like New).

1—50 KW. Chandeysen 20/40 v. sh. wd. dir. con. 75 HP 220/440 v. 3 ph. 60 cy. syn. motor.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

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COMPLETE DIESEL PLANT

3—700 HP Winton 8 cyl. 4 cycle, 360 RPM diesels. 500 KW Elec. Mchy. 3/60/2300 alternators. Switchboards and complete plant auxiliaries. For sale in whole or part. Condition excellent.

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50 KW Electric Machinery Motor Generator Set, 250 Volts D.C., driven by Synchronous Motor.

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500 HP Bros W.T. Boiler, Bros Sprdr. stkr. $7,000
500 HP Vogt W.T. Boiler, Firite Spr. stkr. $7,000
250 HP Vogt W.T. Boiler, Westghse Undf. " $4,500
216 HP Vogt W.T. Boiler, compl. new tubes $3,500
2—150 HP HRT boilers, shell only, $750 & $1,000
Westghse Underf. stkr. 114" gr., pras. new. $2,000

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COMPLETE WITH SWITCHBOARDS

1000 KW to 100 KW

STATIONARY and PORTABLE

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GArfield 5-0433

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REWOUND
REBUILT
RECONDITIONED

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GENERAL ELECTRIC A.C. GENERATOR Serials #135321 & #13536341, Type ATB, 2 KVA 1875, Speed 3600, Form "T", Amperes 164, KW 1500, Volts no load 6600, Volts full load 6600.

CURTIS STEAM TURBINE Serials #18967 & 18966, KW 1500, Speed 3600, Form "B", 3 stage, 200# Steam Pressure, Condensing: P.F. 80%.

CONDITION: These units were completely rebuilt in 1942, and only operated less than one year, as can be certificated by the General Electric Co. We guarantee them to be in good operating condition.

1—25 KVA GASOLINE GENERATOR Mfgr: U. S. Motors, Hercules engine, 240 volts, 60 cycle, 3 phase, 1800 RPM.

1—25 KVA GASOLINE GENERATOR Mfgr: Westinghouse, Leroi engine, 120 volts, 1 phase, 900 RPM.

3—25 KW DIESEL GENERATORS Mfgr: Westinghouse, 450 volts AC, 60 cycle, 3 phase, 42.8 Amps, direct connected to 50 HP Winton Diesel, 3 cylinder.

8—132 KW TURBO GENERATORS Mfgr: Westinghouse (4), General Electric (4), 450 volts AC, 60 cycle, 3 phase, 1200 RPM, 256 Amps, 375# steam pressure, complete with reduction gear and 40 KW exciter.

2—STEAM TURBINES Mfgr: Westinghouse, Serial Nos. 2-A-9229-133 & 134, 6819 RPM, 418 LB.G steam press, 18 LB.G back press, 7763 over speed test, 3100 S.H.P.

2—STEAM TURBINES Mfgr: Westinghouse, Serial Nos. 2-A-9230-133 & 134, 7797 RPM, 26 LB.G steam press, 25 IN. HG. back press, 8967 over speed test, 3100 S.H.P.

TRANSFORMERS

4—750 KVA, G. E. Type "H", Form DD1P, Primary volts 1980, 2090, 2200. Secondary volts 244-488, single phase, 60 cycle. Serial #1374134, #1374133, #1467550.

3—100 KVA, G. E. Type "H", Form "R", primary volts 2200-1980. Secondary volts 220-110, single phase, 60 cycle. Serial #1317448, #1317449.

3—667 KVA Davis Oil Cooled Transformers, 6600, 220/440 with high voltage taps and roof type bushings.

3—667 KVA Davis Oil Cooled Transformers, 6600 to 4000, with high voltage taps and roof type bushings.

All machinery available immediately from stock.

We own what we advertise, we won't list your equipment! We'll buy it.

This is only a partial listing!

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Tioga & Edgemont Streets, Phila. 34, Pa. Ph. Ne 4-1210

TURBO GENERATORS

1—G. E. 1875 K.V.A. Curtis Steam Turbine, 3 stage 200 lbs. steam pressure, 3600 R.P.M. 3 ph. 60 cy. serial 2555795. Wheeler condenser also exciter.

1—G. E. 1250 K.V.A. Curtis Steam Turbine 3 stage 175 lbs. steam pressure, 3600 R.P.M. 3 ph. 60 cy. serial 636308. Wheeler condenser also exciter.

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MACHINERY CORP.

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TURBINE FOR SALE

300 K. W. Gen. Elec. Curtis Steam Turbine type ATB 3 P.F. 3 phase, 60 cycle, 480 volts 3600 R.P.M. Serial #4218901—4 Stage 150# steam pressure. 1st Stage Bleeder at 10 lbs. steam. Alternating current, condenser type. No. 28040 Synchroscope and voltmeters, complete with Worthington condenser. Condition—very good.

Victoria Paper Mills Company, Fulton, New York

Steam Turbine Generator Set

1500 KW Allis Chalmers, 2300 Volts, Throttle Pressure 150 Lbs., Jet Condenser.

Excellent Condition

MARSHFIELD ELECTRIC & WATER DEPARTMENT

MARSHFIELD, WIS.

NORDBERG UNIFLOW ENGINES AND GENERATORS

400 KW. used General Electric generator, 220 volt, 3 phase, 60 cycle, direct connected to 600 HP. Nordberg High Efficiency Uniflow engine.

200 KW. used General Electric generator, 220 volt, 3 phase, 60 cycle, direct connected to 300 HP. Nordberg High Efficiency Uniflow engine.

Now installed complete with switch gears, exciters, etc., can be operated for inspection, will sell as one installation, or separate. Immediate delivery.

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EMERGENCY AND STANDBY GENERATORS

NEW— —SURPLUS

Diesel, Gasoline or Motor Driven

1 to 1,000 KW

Motors, Controls, Transformers, Switch Gear

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Department P

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Everglades 4-5411

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A Wide-Awake Engineer Can Save His Employer Hundreds of Dollars In This Buy!

We have just converted to oil and now have two (2) #C-181 Auburn Underfeed Stokers with coal feed rates of 150#-300# and 500# per hour for sale at ½ less than original cost. Motors, Tuyeres and Plates included. Stokers are less than three years old.

WM. F. MacDONALD, C. E.
Memorial Hospital, Elmhurst, Ill.

HEINE WATER TUBE BOILER

411 HP 200# ALL NEW TUBES

Can ship in one piece

NATIONAL BOILER COMPANY

1501 S. Senate Ave., Indianapolis, Ind.

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For Cash

YOUR SURPLUS

ELECTRIC MOTORS
MOTOR STARTERS
OIL & AIR CIRCUIT BREAKERS
CABLE-WIRING MATERIALS
PANEL BOARD FITTINGS
SPEED REDUCERS
COPPER WIRE

INDUSTRIAL ELECTRIC & SUPPLY CO., INC.

37-1681—Memphis, Tenn.—Box 1398

WANTED

2—400 Amp. 69,000 volt, frame mounted, solenoid operated, three tank, outdoor circuit breakers—GE preferred.

Frequency changer sets—1,000 to 10,000 KVA, 25 cycle, 3 phase input, and 60 cycle, 3 phase output —any voltage or speed.

SOUL CLINIC INC.
Calgary, Alberta, CANADA

WANTED

1—300 KW Turbo-Generator, 160# steam, non-condensing, 5# back pressure 3 ph. 60 cycle.

W8439 POWER

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WANTED

800/1000 KW Engine Generator Set A.C.

URGENTLY NEEDED

500-1000 HP Boilers—Sectional Header

WE BUY COMPLETE POWER PLANTS

H. A. WOODWORTH ENGINEERING CO.

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Telephone Main 1071

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100 HP, 440/3/60, slip ring, explosion-proof motor, 1200 RPM preferred. With explosion-proof control. New or good condition, for quick shipment.

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Alberta, CANADA

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VACUUM PUMPS

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Since 1902

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STEAM DRIVEN — LIKE NEW
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STRAIGHT LINE, TIMKEN BEARING

American Air Compressor Corp.
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MODERN 1000 KW Turbo-Generator

In Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

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100 KW 200 KW

General Motors Diesel engines, 8 cyl., Model 8-268A, 6½" bore x 7" stroke. Direct conn. to: 200 KW WESTINGHOUSE ALTERNATORS, 3 phase, 60 cy., 440 V., including switchboards.

ALSO—COMPLETELY REBUILT

8 cylinder General Motors Diesel Engine Sets Direct Conn. to: 100 KW WESTINGHOUSE ALTERNATORS, 3 phase, 60 cy., 440 Volt, Inc. switchboards.

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SEVEN (7)—150/100/75/50 HP—1800/1200/900/600 RPM General Electric, type KT559A5, 3 Phase, 60 Cycle, 440 Volt,—Ball Bearing—Dripproof Design.

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STEEL STORAGE TANKS
2—1000 & 2—10,000 Bbl. New Vertical
6—74,000, 55,000 & 37,500 Bbl. Vert.
8—25,000 Gal. Cap. Horizontal
50—10,000 & 3—20,000 Gal. Horizontal
6—10,000 & 12,000 & 16,000 Gal. ¾" Shell
20—10,000 Gal. Cap. 60 lbs. Press. Test
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ELECTRIC MOTORS & GENERATORS
Backed by 45 Years of Quality & Service

M-G SETS

KW	Mfr	Input V	Output V
500	Whse.*	2300 AC	250 DC
300	G.E.*	2200/440 AC	275 DC
300	Whse.*	2300/4000 AC	600 DC
200	Ridgeway*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
200	Reliance	2200/440 AC	250 DC
150	Burke*	250/440 AC	250 AC
105	Century b.b.	220/440 AC	70 DC
100	Delco (3)	220/440 AC	125/250 DC
100	Allis Ch.* (2)	2200/440 AC	60 DC
100	Delco b.b.*	2200/440 AC	125/250 DC
100	Gen. Elec.	220/440 AC	125 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
75	Star* b.b. NEW	220/440 AC	250 DC
65	Whse.	220/440 AC	250 DC
60	Gen. Elec.	220/440 AC	30 DC
50	Gen. Elec.	220/440 AC	250 DC
45	Cr. Wh. b.b. (2)	220/440 AC	125 DC
40	Whse. (2)	220/440 AC	125 DC
40	N.W. conv.	220 AC	230 DC
40	G.E.	220/440 AC	250 DC
35	Cr. Wh. b.b. (3)	220/440 AC	125 DC
35	G.E.	220/440 AC	48 DC
25	Burke	220/440 AC	125 DC

*Syn. motor drive.

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
250	Gen. Elec.	RMC	230	550
200	Reliance	1970T	230	575/750
150	Cr. Wheeler b.b.	TEFC	230	800
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
75	Allis Ch.	E-149	230	500
75	Northw'n	K20	230	1750
75	Century NEW	DN	220	850
75	Whse.	SK160	230	850
60	Gen. Elec.	RC 38	230	425/850
60	Cr. Wh.	50H	230	700
60	Reliance b.b.	651T	230	750
60	Gen. Elec.	CD113	230	1150
50	Whse.	SK123	115	1450
50	Gen. Elec.	R.C. 14	250	1050
40/60	Whse.	SK160	230	500/1000
40	Cr. Wheeler	EH	230	1750
40	Whse.	SK110L	230	1750
40	Whse. (2)	SK130	230	950
35/50	Gen. Elec.	CD123	230	575/1150
30	Whse.	SK110L	230	1150
25	G.E. b.b.	CD93	230	1150

- **EXPLOSION PROOF MOTORS—**
- **GEARHEAD MOTORS, AC & DC.**
- **FREQUENCY CHANGERS.**
- **CIRCUIT BREAKERS, AC & DC.**
- **SPEED REDUCERS**

D. C. GENERATORS

HP	Mfr	Type	Volts	Speed
300	Gen. Elec. 1 brg.	DMC	275	720
200	Reliance	1970T	250	720
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500 amp	70	1200
100	Gen. Elec.	C	250	575
100	Gen. Elec.	DLC	125/250	675
75	Allis Ch.	B	250	750
75	Gen. Elec.	RC36	125	1200
65	Whse.	SK160	250	1100
60	Gen. Elec.	RC	250	575
60	Gen. Elec.	CD	250	1450
50	Gen Elec.	R.C. 14	250	1200
50	Cr. Wheeler	50H	250	900
45	Cr. Wh. b.b.	FH	125	1750
40	Whse.	SK	250	1200
35	Cr. Wh. b.b.	35H	125	1750
25	G.E. b.b.	CDM	25	1200

A. C. MOTORS—25 CYCLE

HP	Mfr	Type	Volts	Speed
150	Whse.	HP	440	500
150	Gen. Elec.	IK-16	440	750
50	Gen. Elec. Int.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
50	Gen. Elec.	KT339	440	1500

A. C. GENERATORS—60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
625	G.E 25 cycle	ATB	2300	750
500	Allis Ch.	3 brg.	240/480	360
300	Gen. Elec.	ATB	600	720
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
187	Gen. Elec.	ATB	240/480	900
156	Elec. Machy.	3 brg.	240/480	514
150	Gen. Elec.	ATB	240/480	900
125	Gen. Elec.	ATB	240/480	720
125	Gen. Elec.	ATB	240/480	200
100	El. Machy.	B.B	2400	900
75	G.E. b.b.	ATI	240/480	1200

A. C. MOTORS—SLIP RING
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	I-M	450
1—	450	Gen. El. 2200V.	CW	600
1—	300	Whse. 2200V.	I-P	1200
1—	300	Allis Ch. 2200V.	ANY	720
1—	300	Gen. Elec. 2200V.	I-M	1800
1—	300	G.E. b.b. New	M566	900
1—	250	Allis Ch. 2200V.	ANY	514
1—	200	G.E. 2200V.	I-M 17A	450
2—	200	Gen. Elec. 2200V.	I-M-16	600
1—	200	Gen. Elec.	I-M	900
2—	150	Gen. Elec. 2200V.	I-M-16	600
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Gen. Elec.	I-M-17	450
1—	125	Gen. Elec.	I-M-15	720
1—	100	Gen. Elec.	I-M	1800
1—	100	G.E. Vertical	MT553	1200
2—	100	Gen. Elec.	IM-15A	514
1—	100	Northwestern	HW75A	900
1—	100	Gen. Elec.	I-M	720
1—	75	Howell	SR443	1800
1—	75	Gen. Elec.	I-M-E13	1200
2—	75	Gen. Elec.	I-M-14	720
1—	75	Gen. Elec.	MT558	600
1—	75	G.E. 2200V.	MT556	720
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Gen. Elec. 1ss.	ITC5013	600
1—	75	Whse. 2200V.	CW	600
1—	75	Gen. Elec.	MT552	900
1—	60	Fair. Morse	BV	720
1—	50	Gen. Elec.	I-M	720
1—	50	Gen. Elec.	MT558	1200
2—	40	Whse.	CWC636A	1200
1—	40	Gen. Elec.	MT536	900

A. C. MOTORS—SYNCHRONOUS

HP	Mfr	Type	Volts	Speed
600	Gen. Elec. (2)	TS	2200	514
300	Whse.	G	2200/440	600
300	Gen. Elec.	ATI	440	720
250	Gen. Elec. (2)	TS	220/440	360
220	G.E. 3 brg. SPF	ATI	220/440	600
200	G.E.	TS	220/440	150
200	G.E. SPF	ATI	220/440	900
190	El. Machy.	3 brg.	220/440	514
150	Gen. Elec.	ATI	220/440	300
100	American b.b.	YGH	220/440	900
125	El. Machy. (2)	B.B.	2400/4800	900
125	Whse.	late	2200	1800

A. C. MOTORS—SQUIRREL CAGE
3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	327	Gen. Elec.	KT420	400
1—	300	Allis Ch. 2200V.	AN	720
1—	250	Gen. Elec.	FT549AZ	3600
1—	250	Gen. Elec.	FT549	3600
1—	250	Whse.	CS934A	720
1—	200	Allis. Ch.	AN	1200
1—	200	Whse. b.b. NEW	CS875	1800
1—	150	Gen. Elec. TEFC b.b.	K633338	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Gen. Elec.	KF557	1200
1—	150	Gen. Elec. 2200V	IK-13A	1800
1—	125	Con. 2200V. b.b.	SC	1800
2—	125	Rel. TEFC NEW	B6085	1800
1—	125	F.M. 2200V. vertical	UH-16D	1200
1—	100	Gen. Elec.	I-K	720
2—	100	Allis Ch. 2200V.	AR226	1200
1—	100	Rel. TEFC NEW	C5085	1200
1—	100	Gen. Elec. b.b. NEW	K5048	1800
1—	100	Reliance TEFC	C6085	900
1—	75	Fair. Morse b.b.	HJQ	600
1—	75	Reliance b.b. NEW	C8084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
2—	75	Reliance b.b. NEW	C505	1200
1—	60	G. E. hiterq	KG504	1200
2—	60	Reliance b. NEW	B504	1800
1—	60	Reliance TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
1—	60	Whse. H.T.	CS8594	1800
1—	60	Wagner b.b.	RP444	3600
2—	60	Gen. Elec.	KT343	1200
1—	50	Gen. Elec.	KT556	450
1—	50	G.E. Vertical	KT546	720
1—	50	Whse.	CS752C	720
2—	50	Reliance b.b. New	CC504U	900
1—	50	L.A. 2200 V. Ex. p.f.	E5048	1800
1—	50	Gen. Elec.	KT536	1200
2—	50	Whse.	CS	1200
1—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
1—	50	Whse. hiclip	WL607	900
1—	50	Allis Ch. 2200V.	AR445	1800
2—	40	Gen. Elec.	KT542	720

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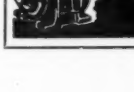

Arthur Wagner Co.

1435 W. RANDOLPH ST. MO nroe 6-7409 CHICAGO 7, ILLINOIS

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5th NORDBERG DIESEL

for Rensselaer Indiana...

OUTLINED here are highlights of the development of the municipal power plant at Rensselaer, Indiana . . . a plant started in 1898 with a 60 H.P. steam engine belted to a 1,000 volt generator, and progressing through 53 years until a total of five Nordberg Diesels were installed to handle the ever increasing load.

The fifth Nordberg now carries a large part of the plant load, operating from 14 to 16 hours each day until the load drops to where smaller units can handle it more economically. Comparing present day output of this new Diesel with that of the plant when Diesels were first installed, we find that in two months the new 2800 H.P. unit generates an amount about equal with the entire annual output in 1925. In one month, this unit generated 475,500 K.W. hours at the rate of 13 K.W. per gallon of fuel, carrying an average load of 54%. Lighting rates at Rensselaer have been among the lowest in Indiana . . . thanks to dependable, low cost Nordberg power.

Here again is a typical example of the way in which Nordberg Diesels provide the economical answer to municipal and industrial power problems. Write for details on a Nordberg engine to meet your requirements—in sizes from 10 to 9600 H.P.

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1928 SECOND Nordberg installed . . . an 875 H.P. unit driving a 600 K.W. generator. Steam plant abandoned.

1932 THIRD Nordberg installed . . . developing 1425 H.P. and 1000 K.W. New building erected and old plant razed.

1940 FOURTH Nordberg installed . . . a 6-cylinder, 1500 H.P. unit, bringing the plant capacity up to 4350 H.P.

1950 FIFTH Nordberg Diesel installed . . . a 7-cylinder, 21½" x 29", 2800 H.P. unit, driving a 2400/4160 volt, 1980 K.W. generator. Total plant capacity now 7150 H.P.

P1050

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NORDBERG
DIESEL ENGINES

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Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.

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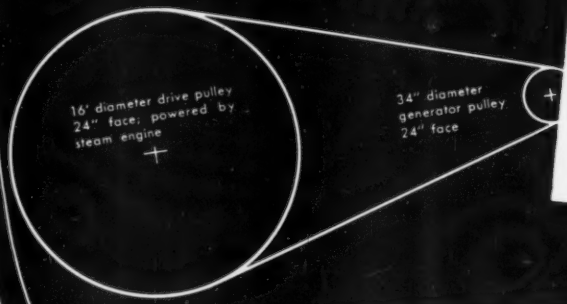

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